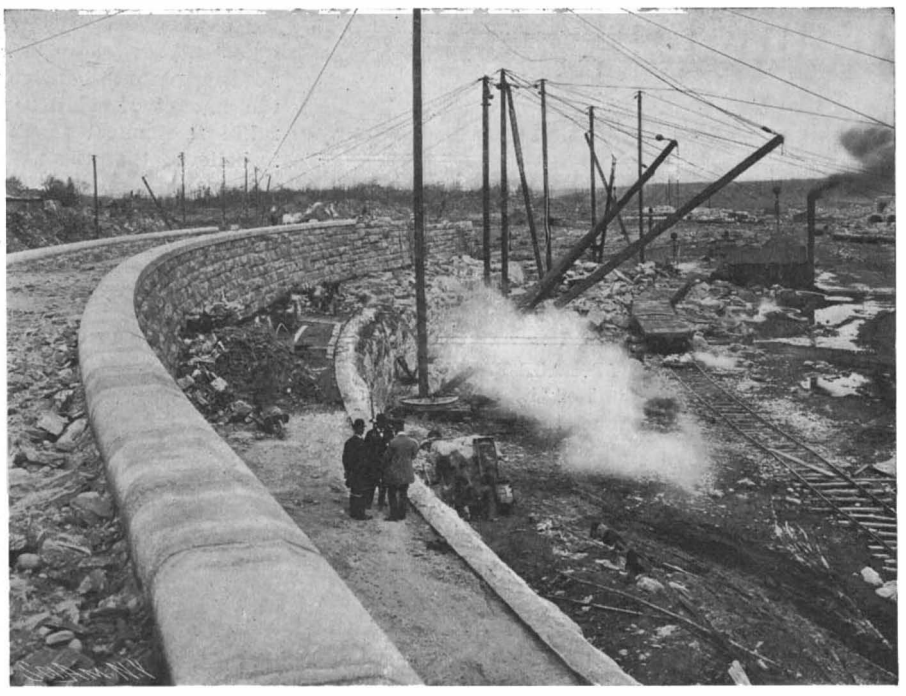
SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyright, 1901, by Munn & Co.]

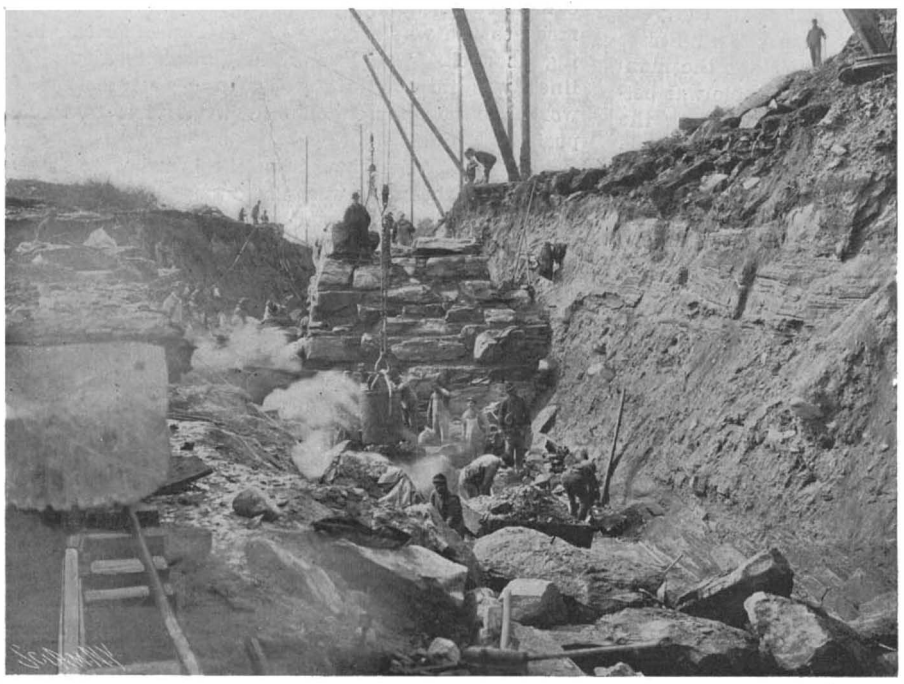
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXXXIV.—No. 22. ESTABLISHED 1845. NEW YORK, JUNE 1, 1901. $3.00 A YEAR. 8 CENTS A COPY.

Dipper Dredge Making Finishing Cut.



A Completed Length of the Triple Aqueduct.



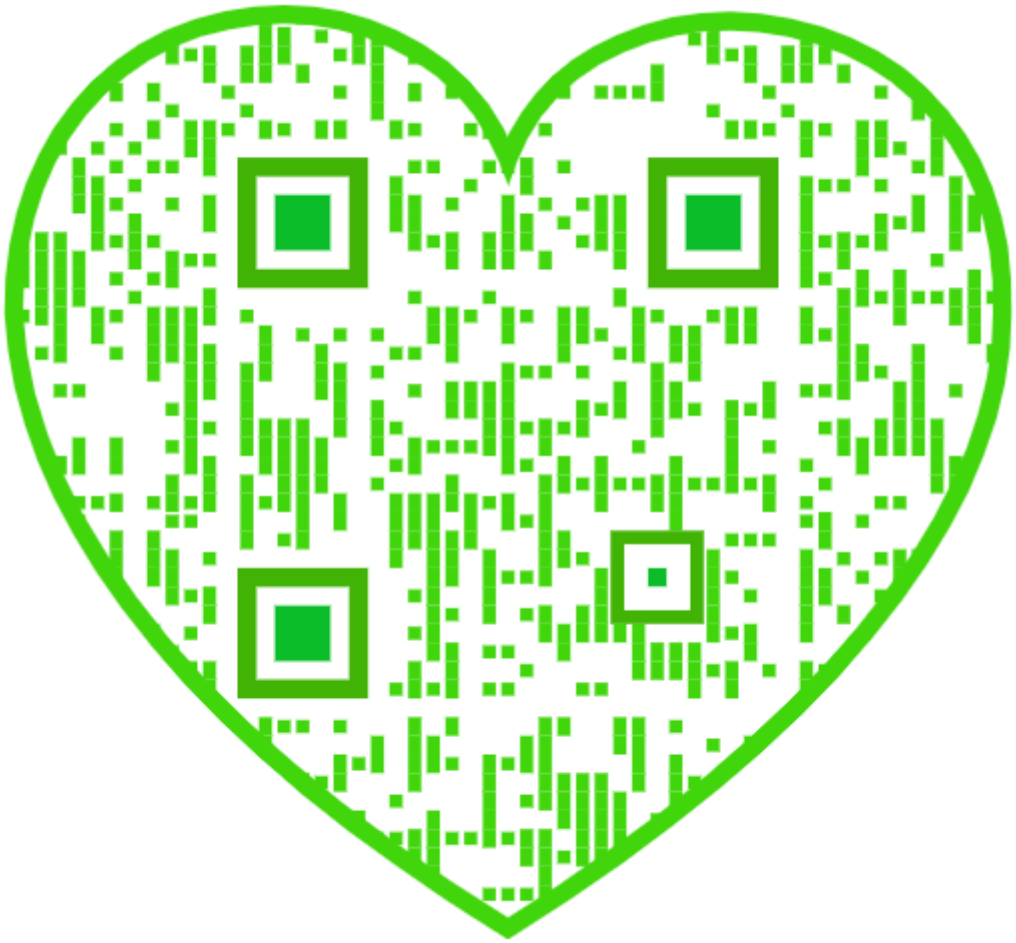
Retaining Wall at West End of Reservoir.

Gatehouse at North End of Reservoir.

Panoramic View of the Work, with Triple Aqueduct in Foreground.

THE WATER SUPPLY OF NEW YORK CITY—JEROME PARK RESERVOIR.—[See page 342.]

© 1901 SCIENTIFIC AMERICAN, INC.



Scientific American.

ESTABLISHED 1845

MUNN & CO., - - - EDITORS AND PROPRIETORS.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

TERMS TO SUBSCRIBERS

One copy, one year, for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845).....$3.00 a year
Scientific American Supplement (Established 1876) ..... 5.00 "
Scientific American Building Edition (Established 1885)..... 2.50 "
Scientific American Export Edition (Established 1878)..... 5.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, corner Franklin Street, New York.

NEW YORK, SATURDAY, JUNE 1, 1901.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE NEW EDISON STORAGE BATTERY.

The first authentic account of the new Edison storage battery was presented at the eighteenth annual meeting of the American Institute of Electrical Engineers, held in New York May 21. The paper was read by Mr. Arthur E. Kennelly. It is well known that the history of the storage cell is essentially that of the lead cell discovered by Planté in 1860, in which lead peroxide is the depolarizing substance. An enormous amount of labor has in the aggregate been expended upon the improvement of this cell in the hands of experimentalists. As a result of that labor the storage battery has at last become a recognized adjunct to direct-curent central stations; but it has limitations that seem to withstand further attempts toward improvement. Of late years hardly any success has been met with in the direction of reducing its weight for a given energy-storage capacity without detriment to endurance, and this weight is the great drawback of the storage battery in electric storage battery traction, and has been the principal obstacle to its advance in this direction for the past twenty years. In practice the storage energy per unit mass of the modern lead battery may be expressed as follows: The battery weighs from 124.5 pounds to 186.5 pounds per horse power hour at its terminals. While it is possible to increase the energy per unit mass by making the electrodes very light, this has always been found to be followed by a very heavy deterioration. Many attempts have also been made to perfect storage cells of the alkaline-zincate type, but the great difficulty of depositing zinc in coherent form from the solution, as well as the lack of a depolarizer that shall be insoluble in the electrolyte, has stood in the way of this cell's success. Mr. Edison set himself to the task of finding a cell which should possess the following advantages: absence of deterioration by work; large storage capacity per unit of mass; capability of being rapidly charged and discharged; capability of withstanding careless treatment; and inexpensiveness. The negative pole or positive element of Mr. Edison's cell, corresponding to the zinc of a primary cell or the spongy lead of a secondary cell, is iron. The positive pole or negative element, corresponding to the carbon of a primary cell or lead peroxide of a secondary cell, is a superoxide of nickel, believed to have the formula NiO_2. The cell is, therefore, a nickel-iron cell, a name which suggests the structural material—nickel-steel. The electrolyte is potash, viz., an aqueous solution containing 10 per cent to 40 per cent by weight, but preferably 20 per cent of potassium hydroxide. In practice with the ordinary storage battery the storage-energy per unit mass of the modern lead battery is from 4 to 6 watt hours per pound of battery; but the storoge capacity of the Edison cell per unit of total mass of steel is 14 watt hours per pound. Expressing the same statement in another way, the weight of the battery per unit of initial energy at the terminals is 53.3 pounds per E. H. P. hour. If the stored energy in the ordinary storage battery available at the terminals were all expended in gravitational work, a battery could raise its own weight to a vertical distance of from 2 to 3 miles. With the Edison battery it could lift its own weight to a vertical distance of approximately 7 miles. The normal discharge period is 3½ hours. The cell may be discharged at a relatively high rate in approximately one hour. Charging and discharging rates are alike. That is to say, the cell may be charged at the normal rate of 3½ hours, or it may be charged at a relatively high rate in one hour with no great detriment beyond a somewhat lower electrical efficiency.

The positive and negative plates are mechanically alike and can scarcely be distinguished by the eye. They differ only in the chemical contents of their pockets. The construction of the battery is fully described in Mr. Kennelly's paper, which is published in full in the current issue of the SUPPLEMENT.

The cell is an oxygen-lift. Charging pulls the oxygen away from the iron and delivers it temporarily to the nickel. The condition is then stable, until the circuit of the cell is completed. The discharge then allows the oxygen to fall back from the nickel to the iron with the natural affinity of iron and oxygen. This action is very different from that which takes place in the lead storage cell. In the new Edison cell the theoretical action of the potash solution is merely to provide the proper channel through which the oxygen ions may travel in one direction or the other—positive plate to negative plate in charge, and negative plate to positive plate in discharge. Secondly, the amount of solution needs only to be sufficient to fulfill mechanical requirements. As regards cost it is believed that the new cells can be produced at a price per kilowatt hour not greater than the prevailing price of lead cells.

LAST OF THE CABLE SYSTEMS IN NEW YORK.

By the time this issue is in the hands of our readers, the cable system of street traction which has done such yeoman service in New York city will be a thing of the past, and electrical traction will have taken another important step toward that day when it will be the only method of traction employed in the transportation of passengers in New York city. It was just a quarter of a century ago that the first cable road built on this continent was constructed in the city of San Francisco, and the system has fully lived up to the high hopes which were entertained of it when the San Francisco lines were opened. Although subsequent to that date, and prior to the inauguration of the Broadway line in New York city, electric traction had begun to assert itself as a practicable system, it was not at first believed to be equal to the successful handling of the enormous traffic which was certain to be encountered on Broadway at the time the cable line was put in. Even as late as the year 1897, President Vreeland, of the Metropolitan Street Railway Company, stated to the editor that the management of that road considered that the cable was better adapted than electrical traction for handling the extremely heavy traffic of that thoroughfare. An experimental underground trolley line, however, was at that time in operation on Lenox Avenue, and the Metropolitan Street Railway Company was carrying on a course of experiments, which have resulted in the equipment of the whole of their north and south lines with the underground trolley system. The first important thoroughfare to be so equipped was the Fourth Avenue and Madison Avenue line. Following this came the electrical equipment of the Sixth Avenue and Eighth Avenue lines. The results, judged from any and every standpoint, have been so invariably successful (the capacity of the line being enormously increased and the operating expenses reduced) that it was only a question of time when the steel cables would be withdrawn from the conduits and the electric cables put in their place. The preliminary work of installing the necessary manholes, insulators, etc., was done last year; and now, with a very brief interruption to traffic, the cable cars have been withdrawn, and the standard electric cars of the company placed on both the Lexington Avenue and Broadway systems. New York city now stands at the very front of the great cities of the world in the matter of rapid, cheap, and convenient street railway service.

OPENING OF THE PAN-AMERICAN EXPOSITION.

The opening of the very complete and altogether beautiful Exposition at Buffalo was marked by several features which render this Exposition unique among the many which are being conceived and carried out with ever-increasing frequency—a frequency which is, in itself, a striking sign of the commercial activity and development of our times. Among the features which entitle this latest effort to distinction are the fact that in conception and execution it is practically the work of a single city; and that in the combined harmony and strong individuality of its grounds and buildings it surpasses any like undertaking that preceded it. Moreover, the Exposition, which was so happily dedicated on the 20th of May, acquires distinction from the fact that there is about its aims and purposes a definiteness which has been lacking in some of the expositions, large and small, which have recently been held.

The proposal to make the Buffalo Exposition distinctly Pan-American seems to have appealed from the very first to the country at large, and to the many republics which are embraced under the comprehensive name adopted. The United States government gave practical proof of its indorsement by an appropriation of $500,000, and emphasized its approval by the statement: "It is desirable to encourage the holding of a Pan-American Exposition on the Niagara frontier, in the city of Buffalo, fittingly to illustrate the marvelous development of the Western Hemisphere during the nineteenth century by a display of arts, industries, manufactures and the products of soil, mine and sea." Invitations were extended by the national government to the various governments of the Western Hemisphere, from Canada on the north to the Argentine Republic on the south. The handsome assistance of the national government, and the hearty and ready co-operation of the governments of the Western Hemisphere found a quick response from the citizens of Buffalo. The matter was taken in hand with such thoroughness that the necessary funds, estimated at $10,000,000, for the larger scope which the plans of the Exposition thereupon took on, were readily forthcoming. New York State appropriated $300,000 and other appropriations, ranging from $75,000 by Illinois to $10,000 by North Dakota, were voted by the various States, with the result that the sponsors of the Exposition were enabled to plan the grounds and buildings on a scale, and with an architectural beauty and finish, which entitle it to rank as one of the largest, and as many will think, the most harmonious and beautiful display of the kind ever attempted. Before leaving the question of finance and management, it is only just to say that the successful carrying out of such an ambitious scheme is the highest possible tribute to the energy, the resourcefulness, and the great public spirit of the citizens of Buffalo and the western section of New York State.

A fact which has contributed largely to the success of the Pan-American Exposition was the timely recognition on the part of the committee in charge of the planning of the grounds and buildings, that both the landscape treatment and the architectural and sculptural elements of the Exposition should be made as highly distinctive and characteristic as possible. Since this was to be an American exposition, it was decided to plan the buildings so that they should be strongly suggestive of the architecture of the new world. At the same time, realizing that in the aptly-named "White City" at Chicago the possibilities of treatment entirely devoid of color had been perhaps exhausted, it was decided to give a general color treatment to the whole group of the Pan-American building as such. The preparation of plans along these lines was intrusted to a board of architects whose work can be appreciated only by a visit to the Exposition itself.

In planning the Exposition the board were favored by the fact that they were not cramped for room. The ground at their disposal being of generous proportions, and of a fairly rectangular shape, they did not have to conform the layout of the buildings and the ornamental features of the ground to any hard-and-fast, predetermined lines. The grounds are about one mile in length and half a mile in width. At the Buffalo end the landscape features are greatly enhanced by two large lakes of water, surrounded by gently sloping and richly wooded grounds, in which are to be found the two permanent buildings of the Exposition—one the Albright Art Gallery and the other the New York State building. Both of these are built of gray-white marble and are classically treated. Passing down through the center of the Exposition grounds, entrance is made to the magnificent approach to the Exposition buildings; and here one has to admit, even with the beauties of the Paris Exposition of last year fresh in mind, that the present effort is more successful, not merely in one, but in every element of its landscape and architectural effects. As the eye ranges down through the long perspective of the Fore Court, the vast Esplanade with its accommodations for a quarter of a million people, the Court of Fountains and the Grand Basin, until it rests upon the stupendous pile of the Electric Tower, which last may truly be called the dominating feature of the whole Exposition, one feels that there is a pervading harmony and proportion which has too often been wanting in displays of this kind. Particularly happy is the way in which the water effects have been worked in among the assembled buildings, whether in the way of winding canals, or broad, placid lakes, or laughing fountains. As one wanders from plaza to courtyard, from courtyard to boulevard, one has a feeling that everything is just about where it should be, that nothing could be omitted without a sense of loss, nor added without a sense of crowding and over elaboration. Amid so much successful treatment, it is difficult to select any feature for special mention; but no doubt there will be a consensus of opinion that the bridge between the Fore Court and the Esplanade, and the Electric Tower with its grandly curving wings springing sheer from the clear waters of the Grand Basin, are two of the most striking among the many beautiful effects which distinguish the Exposition.

Dedication day was a pronounced success, both in respect of the large attendance, which was over 101,000, and the high character of the addresses which marked the opening ceremonies. As was natural, the keynote of the speeches was to be found in the name which is borne by the Exposition. It was certainly pardon-

© 1901 SCIENTIFIC AMERICAN, INC.

able that "America for the Americans" should have been the burden of the addresses; and it was natural, in view of the astonishing progress which has marked the closing years of the old and the opening year of the new century, that there should be an undertone of conviction, sometimes spoken and at all times suggested, that the center of wealth and civilization was finding its way by the inevitable operation of economic and ethnical laws from the Old to the New World.

HIGH-CLASS WORK AT OUR NAVY YARDS.

The successful withdrawal of the damaged gun of the "Kearsarge" and the substitution of a new gun in its place, as carried out at the navy yard, Brooklyn, is another evidence of the high state of efficiency to which this yard has been brought in the past few years—an efficiency, we are happy to say, which, as far as the personnel is concerned, whether in the office or the shops, can be matched at any of the other yards of the navy. From the illustrations and description of these repairs which are given elsewhere in this issue it can be understood that the problem presented was as unprecedented as the method of its solution was ingenious and skillful. We are informed by Naval Constructor Capps, who is now filling the position at the yard vacated by Rear-Admiral Bowles on the latter's recent appointment as Chief of the Bureau of Construction and Repair, that much of the credit for this work is due to the intelligence and skill of the workmen and the great interest which they showed in the successful carrying through of an admittedly difficult job. By the same authority we are assured that his experience of the work and methods at both private and government yards justifies him in saying that results at our naval yards are to-day not merely equal but superior to those secured at the civil establishments. It was not always thus; and the present satisfactory condition of things is to be attributed largely to the emancipation of our navy yards from the last vestige of political control.

THE "FACTOR OF SAFETY" IN "SHAMROCK."

BY OUR ENGLISH CORRESPONDENT.

In the designing of previous challengers for the "America" Cup, Mr. George L. Watson has always been held more or less in check by considerations of cost. On this occasion Sir Thomas Lipton gave him an absolutely free hand in the spending of money, and this is probably the reason why so much experimental work has been done in connection with "Shamrock II." The elaborate tank tests by which the shape of the hull was determined were only the beginning of the experimental work done in connection with the yacht. Sections of every tubular spar, and of every bit of wire used for rigging, were taken and tested to destruction before the weight of materials was fixed. In deciding upon these weights the margin left for safety was of the smallest, and the result brought disaster in the first three or four trials sailed.

The first time she was under canvas in anything of a breeze brought out an abnormal stretch in the running gear and rigging, and the strain of bobstay and jib halyards on the bowsprit end found a decided weakness in the butts in which the heel of the bowsprit is set. They started from the deck, and before she could be brought out again a collar had to be fitted taking in the bowsprit heel and bracing it to the stemhead. When these things were made good she was started again, and this time she caught a shrieking squall which put her to rather a severe test. Again it was demonstrated how small has been the margin allowed for safety; for though the squall was nothing worse than might be expected, even in summer weather, it left her lying helpless like a crippled seabird. It is said that trouble started as she drove before the wind with the breaking of one of the backstay blocks. The boom was square off and one backstay was, of course, slacked away. When the other stay broke the mast whipped like a fishing rod, and it looked for a time as if every spar was going overboard. The mast stood, but the gaff broke short off. The topsail yard was a hollow wooden spar made for "Valkyrie III." and would probably have stood well enough had the gaff held. The gaff was, however, built of steel plates only three-sixteenths of an inch thick, and the jerk of the mast was fatal to it. Discussing the accident afterward Sir Thomas Lipton stated, wisely enough, that if these things were too weak for racing strains, it was better that they should go then than in the actual contest. There is much good sense in this view; but the fact that so many accidents happened in weather which cannot be called abnormal proves how much Mr. Watson has sacrificed to the saving of weight. It has been a commonplace saying with British yachtsmen that the principal factor aiding the Americans in their successful defense of the cup has been the three thousand miles of ocean which divides Great Britain and Sandy Hook. One of the lessons of the trials has been to show that in the building of the latest of the challengers little has been conceded to the demands of the passage. Had the yacht carried any handicap, in the shape of extra weight thrown in to strengthen her for the ocean passage, it is not likely that she would have developed so many weaknesses during the trials.

[The truth of our correspondent's estimate has received a dramatic indorsement in the most unfortunate wrecking of the "Shamrock" by a sudden squall in the Solent. He is right, moreover, in showing that it is not the *dangers* of the Atlantic passage that handicap the challenger so much as the *delay*—the loss of that invaluable time for tuning up, which enables a "Columbia," for instance, though beaten at the start of the season by a "Defender," to beat the older boat by ten minutes before the tuning-up process is over.

For the first time in the history of the races the English yachtsmen have had a good start and a trial boat; but this accident will rob them of all opportunity for tuning-up trials, unless Sir Thomas Lipton is given a sufficient extension of time to compensate him for the delay. The New York Yacht Club has an excellent opportunity to extend a sportsmanlike favor to a gentleman whose sportsmanlike ways have strongly commended him to the American public. There is a further reason for the extension in the fact that the end of August is a most unfavorable time for a contest, and the beginning of October will probably provide better cup-contest conditions than the date at first agreed upon.—ED.]

THE HEAVENS IN JUNE.

The most conspicuous object in the sky during the short June nights will be Jupiter, low in the southeast and south, with Saturn, much less bright, a short distance to the east. The two planets are now moving slowly to the west among the stars in their retrograde motion, and, in consequence of the more rapid motion of Jupiter, are slowly separating. By September the retrograde motion will have ceased, and the two planets will be moving eastward with gradually increasing speed. Jupiter, making the eastward circuit of the heavens in eleven years, will overtake Saturn, moving much more deliberately eastward, in a period of thirty years; and at the end of November will pass by, nearly a moon's diameter to the south.

That Jupiter is much brighter than Saturn, several times as bright, indeed, is evident. But to estimate with any approach to the truth the number of times as bright, without instruments of measurement to assist the vision, is something quite beyond human psychology. In fact, even the measures are not so accurate as might be desired, when the photometer is introduced to suppress a measured percentage of Jupiter's light, so as to have the image seen by transmitted portion, varied at will, to be adjusted equal to the undiminished image of Saturn.

The brightness of either planet varies considerably from time to time. The planet is sometimes a little farther from the sun than the average, and so is less strongly lighted by the central luminary, on whom he is entirely dependent for the light he sends out. He is somewhat nearer to the earth when both are on the same side of the sun, and so he looks a little bigger (in the telescope) and seems a little brighter than when they are on opposite sides of the sun. And in the case of Saturn the splendid ring may be edgewise toward the earth, when, on account of its excessive thinness, the light from it is substantially *nil*; or the ring may be turned up toward us at such an angle that its apparent short diameter is half its long diameter, in which case the ring gives fully as much light as the ball of the planet.

Assuming that the reflecting power of the surface of Saturn is equal to that of the surface of Jupiter, the theoretical ratio of their brightness is readily calculated. Taking the planets as now situated, the distance of Saturn is almost double that of Jupiter, so that, in accordance with the law of inverse squares, a unit of surface on Saturn would receive from the sun scarcely more than a fourth as much as a unit of surface of Jupiter; the distance of Saturn from the earth is a trifle over double that of Jupiter, so that if Saturn's actual radiation were equal to Jupiter's he would seem from the earth to be scarcely a fourth as bright. Of the sun's radiated light, then, Saturn renders to the earth one-sixteenth as good an account per unit of surface as Jupiter. As the diameter of Saturn is 70,000 miles, and that of Jupiter 86,500, the ratio of their surfaces is about as two to three, which would give for the light from the ball of Saturn about one-twenty-fourth, or 4 per cent, of the light of Jupiter. The light from Saturn's ring, which is now only beginning to recede from its widest open position, may be taken equal to that from the ball, so that the total light from Saturn should be, if the reflecting power of the surfaces of the two planets is equal, 8 per cent of the light from Jupiter. That the surface-reflecting power is the same in the two cases seems not to be quite true; photometric measures of the brilliancy of two planets, carefully taken, and compared with their theoretical brilliancy, indicate that the surface of Jupiter reflects about 60 per cent of the light received, and the surface of Saturn about 70 per cent. Perhaps it would be safe, at the present time, to take the brightness of Jupiter to be ten times the brightness of Saturn.

After their opposition to the sun in July both will decline a little in brightness, Jupiter a little more than Saturn.

Aside from the ring of Saturn, which is absolutely unique, the two planets are much alike. They are much larger than any of the other planets of the solar system. They both have a very low density, Jupiter a little more, Saturn a little less, than water. Both are brighter at the center than at the edge, and both have belts as their chief surface markings. Both rotate in about ten hours. Their spectra are very similar, giving strong atmospheric indications. On Jupiter at least the movements of the numerous spots are incompatible with a solid surface such as the earth's, while presumably Saturn's surface is similarly mobile; indeed, some suspicion exists that possibly there may be nothing of a true solid about either planet, even at the center.

THE PLANETS.

Mercury will be visible the entire month, just after sunset, near to the horizon, a little north of west. This will be an unusually good opportunity to look at the innermost planet, which so few people have ever seen; in fact, in spite of the smallness of the area of the eclipse track of May, 1900, probably many more people saw Mercury, then close to the sun's corona, than have seen him the world over for the last ten years. Venus will be far enough away from the sun after the middle of the month to be comfortably seen; and at the end of the month will begin to be a good evening star, with Mercury a few degrees to the south. Mars will be seen in the west in the evening, having decreased in brightness so much as to be no longer conspicuous. Jupiter and Saturn will rise about dark and will be prominent objects the entire night, low in the southeast and south. Uranus will be visible to the unassisted eye as a very faint star about ten degrees east of the bright star Antares.

THE CONSTELLATIONS.

Bootes will be overhead in the early evening, with Arcturus the most conspicuous star. Virgo will be in the southwest, and Scorpio in the south, the long curving line of stars of the latter stretching down from Antares being readily traceable on nights when the haze will permit. Ursa Major, with the big dipper conspicuous, will be in the northwest, rather high up. Aquila will be coming up in the east, and Lyra and Cygnus in the northeast. This portion of the heavens, while not very brilliant, is still a great improvement on the very dull constellations of the spring months.

SCIENCE NOTES.

Dr. Franz Melde, professor of physics in the University of Marburg, died recently.

Dr. William Jay Youmans, for many years the editor of the Popular Science Monthly, died April 10. He established the monthly in 1875.

A new form of sealing wax has recently been devised. It differs from the ordinary stick wax in that it is inclosed in a glass tube, from which it may be poured by heating the cylinder.

The St. Louis World's Fair, which is to celebrate the centennial of the Louisiana Purchase, may be said to have made a beginning by the passage of an ordinance by the city of St. Louis authorizing the issue of $5,000,000 in bonds. Congress may appropriate an equal sum at its next session.

The Peary Arctic Club has chartered for its work this summer the steamer "Erik," which was recently purchased from the Hudson Bay Company. The cruise of 1901 is the fourth of the series under the direction of the club to assist Lieutenant Peary. The "Erik" will sail from Sydney about the middle of July, and will return about two months later with full details of what has transpired in the two years since Peary has been heard from.

The eclipse expeditions report varying success in the observation of the eclipse on May 18. At Singkel, Sumatra, Prof. Todd reports that while the weather was good the sky was cloudy, and during the total eclipse of the sun no instruments could be operated except the polariscope and the X-ray apparatus. Six auxiliary stations were established on adjacent islands within 33 miles, and three of them showed a clear eclipse. No shadow bands were seen and the corona was invisible. President Pritchett, of the Massachusetts Institute of Technology, received a cable message from Prof. Burton, in charge of the Technology eclipse party, announcing that important results had been obtained. The weather was cloudy during a portion of the eclipse, but all four contacts were observed and a brilliant corona was shown at totality which lasted nearly six minutes. Photographs were obtained. The most interesting and novel work of the party consisted in the observations obtained photographically of the shadow bands.

© 1901 SCIENTIFIC AMERICAN, INC.

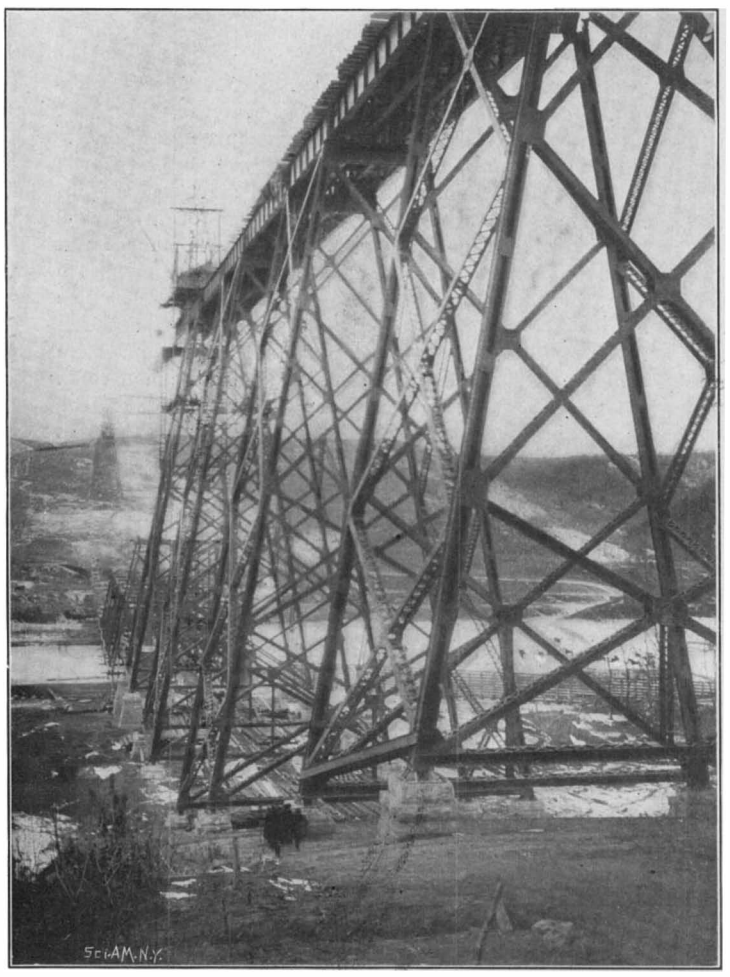
DOUBLE-TRACK RAILWAY VIADUCT OVER THE DES MOINES RIVER.

There is nearing completion across the Des Moines River what will be considerably the longest railway viaduct for its height in existence. While there are other viaducts of considerably greater height, what makes the Boone viaduct, as it is called locally, remarkable is the combination of height and length, and the fact of its being a double-track structure. In point of total weight of metal employed in its construction it is fully three times as heavy as the next largest bridge of the kind in the world.

	Kinzua.	Loa.	Pecos.	Des Moines.
Length	2,050	800	2,180	2,685
Height above water	302	336	321	185
Greatest width at base	103	124	90	70
Width at grade	18	13	16	27
Number of tracks	1	1	1	2
Tons of metal	1,400	1,115	1,820	5,680

The loftiest of these structures is on the line of the Antofagasta Railway in Bolivia and is known as the Loa viaduct. It was constructed by English engineers in the year 1889. The height of the tracks above the water is 336 feet. As the crossing is over a narrow cañon, the length is only 800 feet; the great depth, however, involves a proportionate width of the towers at the base, the extreme spread of the columns being 124 feet. The next in point of height is the Pecos viaduct, which carries the Southern Pacific Railway over the Pecos River in Texas. This structure, which was built in 1892, is but little lower than the Bolivia viaduct, the height from water to rail being 321 feet, and the total length from abutment to abutment is 2,180 feet. Then comes the Kinzua viaduct, 302 feet above the water and 2,050 feet in length. These three viaducts carry only a single track; and, as we have said, it is the width and consequent weight of the floor system, and the great breadth of the whole structure, which render the Des Moines viaduct so much larger than the other three, the total weight of steel in the structure being 5680 tons, as against 1,820 tons in the Pecos, 1,400 tons in the old Kinzua viaduct, and 1,115 tons for the Loa viaduct.

The Des Moines structure consists of the viaduct proper, built of plate girder spans carried on braced towers, and a 300-foot truss across the channel of the river. The towers consist of four legs of built-up latticed construction, with strong lateral and longitudinal bracing between them. The spans across the towers are 45 feet in length and the spans between the towers are 75 feet. The substructure was built in the ordinary method, by means of derricks, which were carried by the towers, as they were built up, section by section, to the level of the underside of the plate girder superstructure. It should be explained that the much greater weight of the Des Moines viaduct as compared with the others mentioned in our comparison is to be attributed not merely to the fact that it carries two tracks, but also to the extra-ordinary increase which has taken place of late years in the weight both of locomotives and rolling stock. The single-track viaducts were constructed at a time when the maximum load on the axles of rolling stock was very much lighter than it is to-day. A striking instance of the increase in weight of bridges, due to this, is shown in the comparison of the new Kinzua viaduct with the old one, the weight of the metal in the new structure having been increased forty per cent to meet the heavier rolling stock of the present day.



A Near View of One of the Towers.

The Preservation of Stonehenge.

A party of representatives of societies interested in archæology recently met Sir Edmund Antrobus at Stonehenge to discuss the details of the resolution passed at the recent conference in London. The party approved of all the suggestions made at the London conference. The work will be carried out as soon as the weather is favorable, by an architect and a civil engineer. Nothing in the way of restoration will be attempted, the only object the societies have in view being the preservation of this most ancient memorial. The first work will be the raising of the huge monolith which overhangs the altar stone, as it is in a most dangerous condition, into an upright position. It is the largest and finest monolith in England, next to Cleopatra's Needle. At present it rests on a smaller stone, but there are two large flaws, or cracks, in it, and if it were to fall it is feared that it would be broken into three parts. Other stones will be put in position to support the lintel, which will rest upon them. Sir Edmund Antrobus hopes to obtain permission to divert the roadway now passing through the earth circle which surrounds the stones and to proceed with the erection of a wire fence as approved by the conference in London.

The Union Iron Works has decided to use oil for fuel in their plant, and the necessary changes in the furnaces are being made.

Present Status of the Telephone Business.

BY ALTON D. ADAMS.

The public is now to have the benefits of free and active competition in the telephone business. Judge Brown, of the United States Circuit Court, by the decision rendered at Boston on February 27, has opened the manufacture and sale of telephones and the operation of exchanges to all who care to enter these lines. The Berliner microphone patent, declared invalid by Judge Brown, was the only one of general application that independent manufacturers and operators have had to fear in the hands of the American Bell Telephone Company.

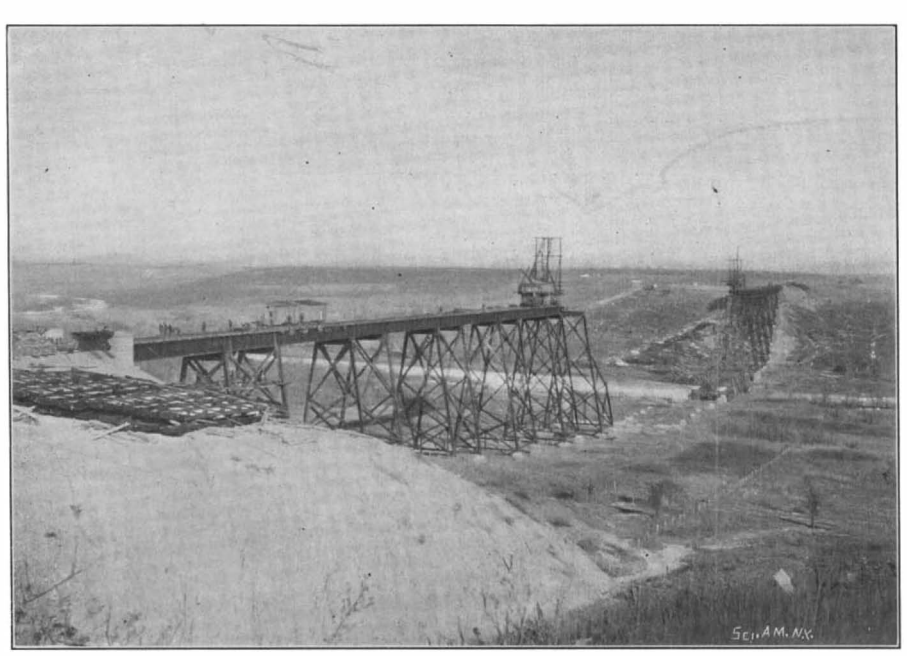
A direct result of this decision must be a large increase of the flow of capital to the telephone business, for the fear of infringement has greatly retarded investment along this line.

A large number of minor patents on details of construction are held by the Bell Company, but this is none the less true for the independent companies, and there is probably little real advantage to be gained on either side by extensive litigation over details of construction. From now on the success of telephone enterprises must, in the main, depend on the quality of service and the price at which it is rendered.

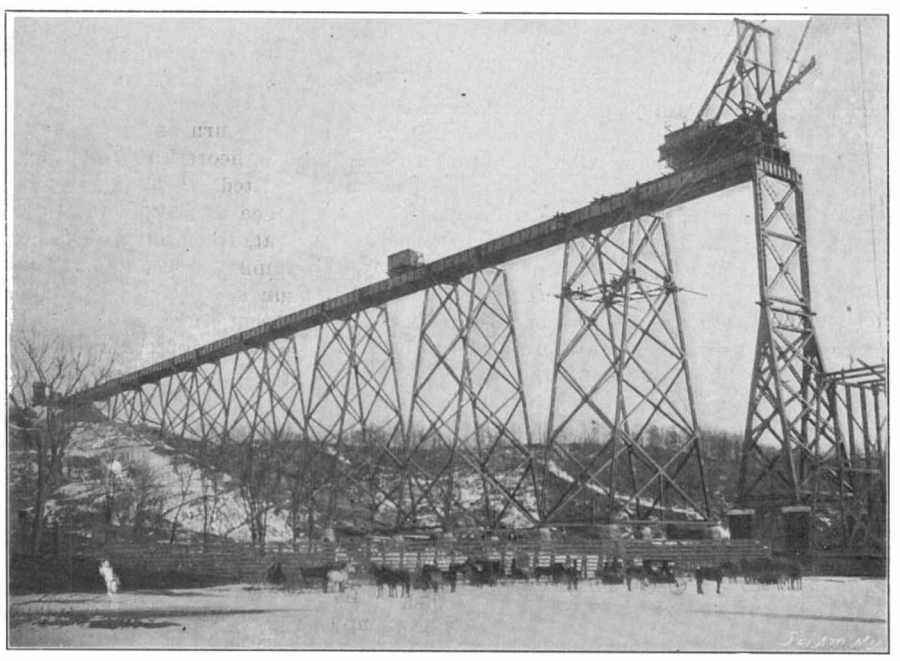
One tendency of the development of telephone service has been to lessen the business done over telegraph lines. This tendency must certainly increase with the future rapid extension of telephone systems, so long as the two kinds of service take place over distinct lines. Both telegraph and telephone systems require enormous plants, mostly in the form of transmission lines. Telegraph lines are comparatively idle during the day, but well employed at night, while the reverse is true for telephone lines. A moderate addition to the equipment of either system, at stations or exchanges, would enable it to compete in the long distance service now performed by the other. These conditions must operate as a spur to improve and cheapen the service of both telephone and telegraph companies, and may eventually lead to a union of these interests.

Whirlwinds Observed in Germany.

According to the Meteorologische Zeitschrift a remarkable series of whirlwinds was observed in Germany on the 26th of last June. The whirlwinds made their appearance at Hine near Seismberg and were seen toward 10 h. 45 m. A. M. on the slope of the Gatscheer Mountain. The first of these whirlwinds looked like a column of cloud or mist twisted in a screw-like form, rising up below a cloud which was moving slowly from east to west, and it afterward joined the cloud. Soon after a second whirlwind was seen to rise a little farther toward the east and this was shortly followed by others. The region is partly covered with oak trees, and at the points where the columns were seen to form, the oaks were uprooted and lay upon the ground. This uprooting of the trees took place only here and there, and thus a number of trees quite distant from one another were felled, while the trees separating them remained intact. It is also remarkable that this great development of force took place without the least agitation of the air being felt in the neighborhood. The series of whirlwinds were found at distances of 500 to 600 feet apart.



General View of the Viaduct.



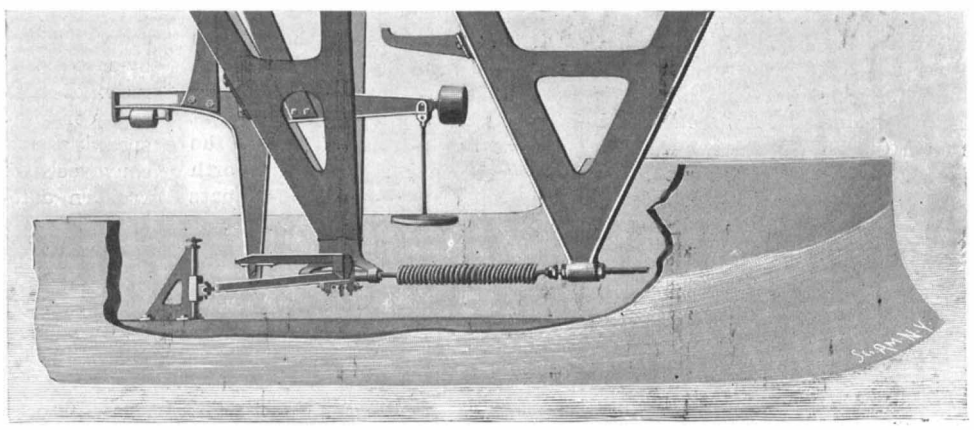
At the Channel Crossing, Showing Bridge Pier.

DOUBLE-TRACK RAILWAY VIADUCT ACROSS THE DES MOINES RIVER, NEAR BOONE, IOWA.

© 1901 SCIENTIFIC AMERICAN, INC.

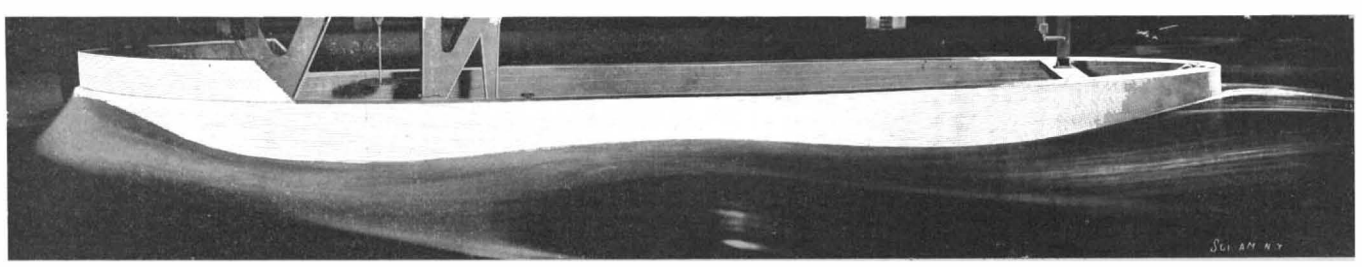
THE UNITED STATES EXPERIMENTAL MODEL BASIN.

The method of determining the resistance of a ship by towing a small-scale model of the same was originated by the late William Froude, who built a small tank for such work at Torquay, England. Demonstrations there made induced the English Admiralty to build a much larger basin at Hasler, near Portsmouth. In time other governments, particularly Italy and Russia, built similar basins, and one firm of private shipbuilders, Denny Brothers, were sufficiently enterprising to build a basin of their own. In this connection it is of interest to remember that the designer of "Shamrock II." carried on a series of experiments in the Denny Brothers' tank, which extended over a period of nine months, and that the model of the new yacht, according to its owner, has been determined largely by the results thus obtained, over sixty different models having been experimented with.

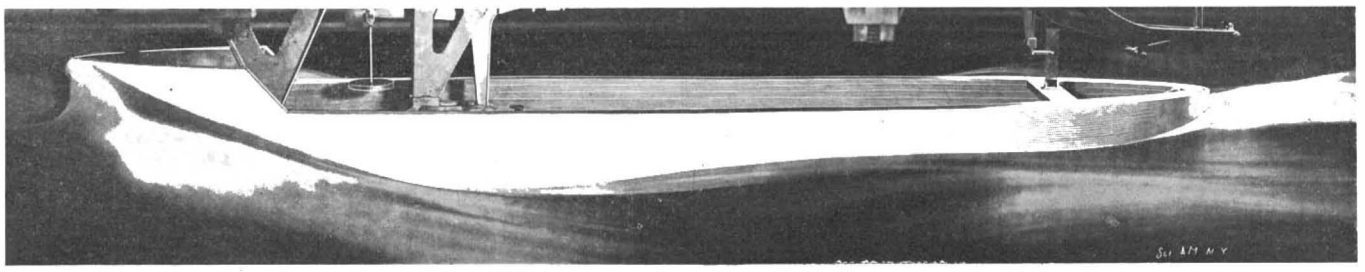


METHOD OF ATTACHMENT OF MODEL TO TOWING PLATFORM.

The United States experimental model basin is situated in the Washington Navy Yard. The building is 500 feet in length and 50 feet inside width, the water surface of the tank being 470 feet in length, and the deep portion of the tank 370 feet long. The water surface is 43 feet wide, and the depth from the top coping to the bottom of the basin is a few inches under 15 feet. The basin is spanned by an electrically-driven towing carriage, which is capable of a wide variation of speed, and is provided with a very complete system of stopping and starting control, all of which is operated from the platform of the carriage. The models are attached beneath the platform in the method shown in our engravings. A pair of brackets extends vertically beneath the bottom of the platform. They carry at their lower end a towing rod, which is connected to the dynamometric apparatus by which the resistance of the model is automatically recorded upon a drum, carried upon the platform above. The resistance is measured directly by a spring. The forward end of the spring is attached to a bracket which is screwed forward or backward by an electric motor, and a rigid arm runs up from the bracket and carries a pencil which records its position on the drum. The record, then, is of the position of the forward bracket. The after end of the spring takes hold of a small crosshead, to the other end of which is attached a towing rod, which takes hold of the model. This crosshead has a very slight play between stops in the after fixed bracket, and when it touches either stop it closes an electrical contact which further throws an electric clutch, by means of which a motor running all the time screws forward or backward the forward bracket, thus increasing or decreasing the tension of the spring until the contact is opened again. After the carriage has been started and a uniform speed is obtained, the operator throws in certain automatic appliances which start the record drum. The drum makes a record of the time, the run, and the resistance of the model. The amount of the pull of the towing rod, which, of course, represents the resistance of the model, is determined by means of a kind of weighing machine, which is provided with one vertical and one horizontal arm, the machine being delicately balanced. When the model has been connected up and is ready for towing, a knife edge, which bears upon the vertical arm, is connected to the model, and a known weight is put into the scale-pan attached to the horizontal arm. The automatic attachment in connection with the dynamometer spring is then thrown into gear, and the weighing machine is screwed forward or backward until it is in perfect balance. Under these conditions the pull of the spring is exactly equal to the weight in the scale pan.



WAVE-LINE OF "GEORGIA" MODEL AT 6 KNOTS; EQUIVALENT TO 27·5 KNOTS.



WAVE-LINE OF "GEORGIA" MODEL AT 4·15 KNOTS; EQUIVALENT TO 19 KNOTS.

The models are of a uniform length of 20 feet, and they are built with the greatest care exactly to scale, being in their lines and displacements a perfect reproduction of the ship whose resistance is to be determined. Mr. Froude determined a formula giving the ratio of the resistance of the model at a certain speed to the resistance of the full-sized vessel at the speed at which the latter is designed to run. In making tests the model is towed at various speeds, and a curve of resistance is plotted from which the naval architect is enabled to determine with great exactness the amount of resistance of the full-sized vessel and, therefore, the total horsepower which will be required to drive her at various speeds. Two of our illustrations show the wave line produced by the model of the battleship "Georgia," when it was being towed at speeds of 4.15 knots and 6 knots, which correspond respectively to speeds of 19 knots and 27.50 knots in the full sized vessel. Regarding the change of level of the models under different speeds, the tests developed the fact that at low speeds of 2 or 4 knots, both bow and stern settle. As the speed increases, the bow gradually ceases to settle, and then begins to rise rather rapidly. A rather rapid rise continues until the bow returns to its original level, and if the speed is pushed high enough it rises above that level. As the bow tends to rise, the stern shows a tendency to sink more rapidly, with the result that the center of the model invariably settles when it is well under way. The fact that the model settles bodily does not necessarily imply greater immersion, since the water level is disturbed by the passage of the model. In conclusion it is interesting to compare the maximum speeds of vessels whose models have been tested with the corresponding speeds of the models. Thus the "Oregon" class, 348 feet in length, showed a speed of 16.8 knots for a model speed of 4.03 knots; the "Kentucky" and "Alabama" class, 368 feet in length, a speed of 17.1 knots as compared with the model speed of 3.99 knots; while the "Georgia" class, for a length of 435 feet and an estimated maximum speed of 19 knots, showed in the models a corresponding speed of 4.07 knots. We are indebted for our photographs to the courtesy of Rear-Admiral Bowles and Naval Constructor Taylor, who has the towing tank immediately under his charge.

The Niagara Falls Power Company is about to proceed with the development of the power of the Horseshoe Falls. The present plan of the company is to develop 35,000 horse power. A third of this amount will be used to operate an industrial establishment outside Victoria Park, on the Canadian side; a third is to be transmitted to Toronto, and the remainder is to be held in reserve for the use of the Niagara Falls Power Company.

GENERAL VIEW OF MODEL BASIN, SHOWING TOWING-CARRIAGE WITH MODEL ATTACHED.

© 1901 SCIENTIFIC AMERICAN, INC.

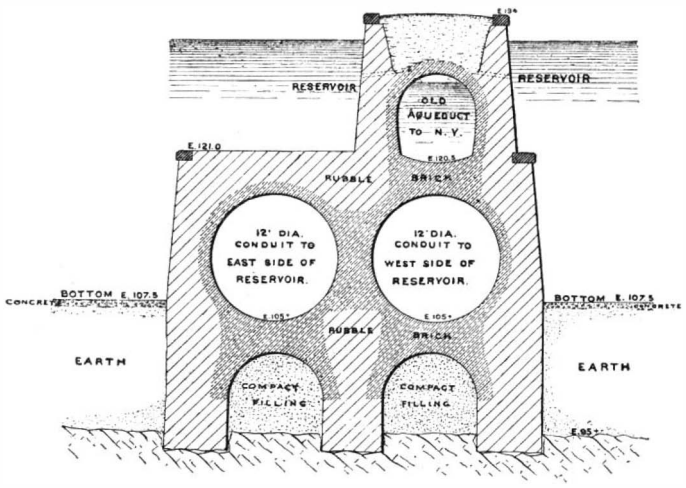
JEROME PARK RESERVOIR.

It is now nearly seventy years since the authorities of this city began the serious study of the problem of New York city's water supply, which resulted in the construction of the Croton reservoir, some 40 miles north of the city. The scheme as ultimately developed included this reservoir and an aqueduct now known as the Old Aqueduct, which extended from the reservoir to New York, and had a capacity when running entirely full of 90,000,000 gallons in twenty-four hours. In 1890 the new aqueduct with a capacity of 300,000,000 gallons per day was completed. This structure was built as far as possible in tunnel, and was carried in a practically straight line from Croton reservoir to the Harlem River. Both aqueducts discharge directly into a terminal gate-house at 135th Street, from which the water is led by 48-inch pipes into the city mains, and into the Central Park reservoirs, which latter have a capacity of a billion gallons of water, or sufficient for something over four days' supply for the city. As a result of the comparatively low level of these reservoirs, the high-water level being only 115 feet above the sea, the pressure fails before they are empty, and the remaining water ceases to be available on the higher floors of the city buildings. On this account, the actual supply available in the Central Park reservoirs is only sufficient for about three and a half days, and were there to be any failure of the Croton reservoir, or in the connecting aqueducts, the city would be confronted with a water famine. It was for these reasons that the Aqueduct Commissioners determined five years ago to construct an additional reservoir at the city end of the line, to have about double the capacity of those in Central Park.

The Jerome Park reservoir, as the new storage basin is called, is located on a lofty ridge, which runs north and south between the valleys in which are located the New York and Putnam and the Harlem railroads. It takes its name from the famous race-course, which is indicated in the accompanying map of the locality, by the white dotted line within the area of the reservoir. The site is admirably adapted by nature for the excavation of a large artificial basin; for at this point there is a general depression in the summit of the ridge, and the labor of excavating and embanking the reservoir has been proportionately lessened. The greatest length of the reservoir in a north and south direction is a little over one mile, and its greatest width half a mile, its area being 229 acres. The whole of the bottom is being excavated to a uniform depth of 26½ feet. Such is the configuration of the ground that for about half a mile of the perimeter of the lake the waters will be held in by the natural ground, and the other half will be contained by an artificial embankment, built of earth put down in 6-inch layers and well rolled and tamped. The outer face, which has a slope of 2 to 1, will be sodded, and the inner face with a similar slope will be covered with 6 inches of concrete and a paving of granite blocks, the paving being carried up to about 2½ feet above high-water line. The embankment is 20 feet wide at the top, and to assist in rendering it perfectly impervious to water, a vertical wall of first-class masonry has been built in the center of the embankment, starting from bed-rock and rising to a level somewhat above the high-water line. As is explained later in this article this form of embankment has been modified wherever the nature of the subsoil demanded a heavy retaining wall on the inner face.

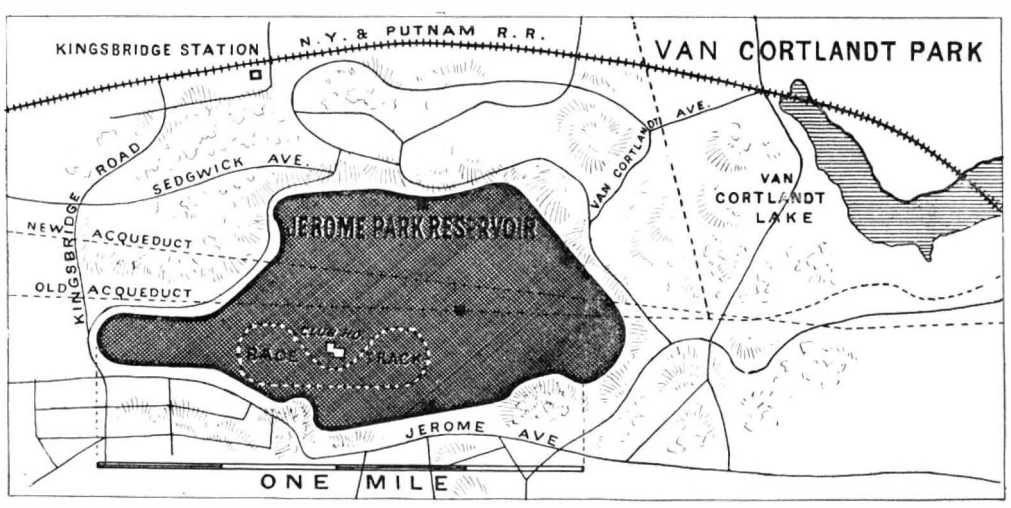
Although the total amount of excavation is greatly lessened by the natural depression of the ground, there is no point where it is carried less than 16 feet below the natural surface, the bottom of the finished reservoir being everywhere 31½ feet below the top of the embankment. Add to this the fact that there are many parts of the site, such as the rising ground upon which the old Jerome Park Club House stood, which were considerably higher than the present top of the embankment, and it will be understood that the total yardage to be excavated reaches a very high figure. As a matter of fact, the total estimated excavation at the commencement of the works was 6,500,000 cubic yards, of which at least one-half is solid rock; and since excavated rock occupies about double the space that it does in the solid mass, and subsequent changes have raised this total by 300,000 cubic yards, the contractors, by the time they have completed their work, will have to dispose of about 10,000,000 cubic yards of material. At the present writing an estimated total excavation of 3,933,000 cubic yards has been taken out, loaded on cars and carried, most of it, toward Long Island Sound, where it is being used in filling in swampy ground and depressions in Bronx and Pelham Parks. The excavation is being carried on with powerful steam dredges and diggers; and during the past three years the interior of the basin has been covered with a network of tracks. As the work was carried down to grade, the tracks were removed, and at present they are concentrated against the western wall of rock. They lead to a main line, which passes out of the reservoir, crosses the Harlem Railroad tracks by means of a bridge, and runs down to the tide lands of Long Island Sound.

Two of our illustrations show the very important work which is being done in the construction of the triple aqueduct which bisects the reservoir from north to south. Both the old and the new aqueducts pass through the site of the Jerome Park reservoir on their



SECTION THROUGH TRIPLE AQUEDUCT BELOW MAIN GATE HOUSE.

way to the city, their position being indicated by the dotted lines in the accompanying map. The old aqueduct was at ground level and the new aqueduct some 100 feet below the surface. The bottom of the reservoir is below the old aqueduct foundation, hence it was necessary to remove the latter altogether, and build an entirely new structure, in which has been incorporated a branch aqueduct from the new aqueduct. At a point about a mile to the north of the reservoir the new aqueduct is at ground level. Here it begins to descend, and is carried in a tunnel at a depth of about 100 feet below the reservoir. At the center of the reservoir a vertical shaft rises from the aqueduct to the reservoir bottom. A gate-house has been put in the new aqueduct where the tunnel commences and a surface branch of it has been built, which runs parallel with the old aqueduct until the northern entrance of the reservoir is reached. Here the branch and the old aqueduct are embodied in one compact masonry structure, which is built up from the solid rock of the reservoir bottom, and extends from northeast to southwest, dividing the reservoir into two



MAP OF JEROME PARK RESERVOIR AND VICINITY.

separate basins. Opposite the point where the shaft which rises from the aqueduct tunnel pierces the reservoir, there is a large main gate-house which connects with the shaft by a short conduit. To the south of the gate-house the new aqueduct is carried through the reservoir as a double-barrel conduit, each conduit being 11 feet in diameter, and the old aqueduct is carried above these at its former elevation, as shown in the accompanying figure. Fifteen hundred feet south of the gate-house one of these conduits leads into the western, and the other into the eastern basin of the reservoir. Radiating from the main central gate-house are six lines of 48-inch pipe, two of which leave the reservoir to the northwest, two to the west, and two to the southeast, one of these leading to a high service pumping station. At each of these three points of exit is a gate-house, and the main gate-house connections are so arranged that these pipes may be supplied with water from either basin of the reservoir, or directly from either the old or new aqueduct.

The plans for this gate-house, which is one of the most important pieces of work in the whole scheme, have been revised by the present Chief Engineer of the Aqueduct Commission, William R. Hill. The present design is so arranged as to secure a maximum number of combinations and by-passes for the proper control of the water. The mass of masonry is approximately circular in plan and contains within it 22 separate gates. Broadly speaking, it may be said that the new aqueduct is conveyed directly through the northeastern and southwestern axis of the main gate-house, while the old aqueduct is conducted in a broad curve around its western circumference. The total amount of excavation has been raised by certain changes in the direction of the embankment along the northwesterly side of the reservoir, where for a length of 2,300 feet the central core wall has been dispensed with and a massive retaining wall carried from the high-water level down to bed-rock has been substituted on the inner face of the embankment. This was necessitated by the exceedingly poor nature of the sub-soil at this place, which was found to approximate a shifting quicksand in constituency. The extra excavation necessitated by this form of wall has provided a larger water space within the reservoir, and it has been found that the saving in concrete and paving secured by dispensing with the inner sloping of the embankment at this point and the value of the increased storage for water more than offsets the extra cost of the heavy retaining wall. The present estimate for the total excavation is 6,900,000 cubic yards of material, of which 3,900,000 is earth and 3,000,000 is solid rock. Of this total 2,286,000 cubic yards of earth has been taken out and 1,647,000 yards of rock, so that something less than two-thirds of the work has been completed. The capacity of the easterly basin is 1,085,000,000 gallons, and the capacity of the westerly basin 765,000,000, making a total of 1,850,000,000 gallons. It is expected that the excavation of the westerly side of the reservoir will be completed this year, and that in the spring of 1902 the process of concreting and finishing will be under way, in which case one basin of the reservoir will be in use some time during the latter part of 1902 or the spring of 1903. The total cost of the finished work will be $5,840,000.

In a subsequent article we shall treat of the methods of excavating and handling the material on this great work.

German Life-Saving Apparatus.

A new life-saving apparatus is being introduced into Germany. It consists of a buoy of globular form and carrying from two to four life belts, and supports a long cylinder of sheet tin having twelve compartments filled with carbide of calcium. These compartments are arranged at different elevations. When the apparatus is thrown into the sea, the water passes through perforations in the bottom of the cylinder, and, coming in contact with the carbide, generates acetylene gas. Each compartment is connected with a burner by a pipe, valves preventing the escape of gas except through the burner. When the volume of gas decreases, hydrostatic pressure opens the valves and allows water to penetrate into the next compartment to generate an additional supply of gas. The gas is lighted electrically, and ignition takes place about twenty-five seconds after the buoy is thrown into the sea. The light produced is equal to 150 candle power, and the flame is protected from the wind by glass and burns steadily with great intensity for three or four hours. It requires only a few minutes to clean and refill the apparatus.

Atlanta and Dayton have a unique system in their fire departments. They clean up the premises after the fire is out, and at Atlanta each hook-and-ladder truck has, in addition to the regular equipment, tarpaulins, tubs, buckets, sponges, brooms, and everything necessary for cleaning up a building after a fire. After the conflagration is over, the firemen take out all of the burnt timber, plaster, laths, etc., in the building that has not been entirely destroyed. The goods are covered with tarpaulins to prevent water and plaster from falling on them, and the removal of the charred boards, planks and plaster never fails to decrease the fire loss. The expense is practically nothing, as the work is done by the firemen.

© 1901 SCIENTIFIC AMERICAN, INC.

Automobile News.

The well-known English constructors, Vickers, Sons & Maxim, have lately built an automobile mitrailleuse of the Simms type, designed to run upon rails and replace the present system of armored trains. It is driven by a 7 horse power Simms motor, with ignition by magneto machine. Three speeds are provided—8, 16 and 24 miles an hour. The motor is water-cooled, and it is stated that only two gallons of water are required. The total weight of the machine is 2,800 pounds. The length is 7 feet, width 5 feet 6 inches, height 4 feet. It is completely protected with armor and the wheels are covered.

The automobile designed for the Shah of Persia has recently been finished by a Belgian firm. This vehicle is a landau of five places, and cost no less than $22,000. The interior is upholstered in pale gray brocaded silk, and the carriage body is finished in blue with gold ornamentation; the wheels and truck are in red. At the sides are two lanterns of very handsome design, of gilded metal work and beveled glass, bearing the Lion and the Sun of Persia. The carriage body is ornamented with the arms of the Shah, whose name is surrounded by a branch of laurel and of oak, surmounted by the imperial crown.

The Artillery Station at Vincennes, near Paris, is making arrangements to purchase all the automobiles possible in case of mobilization, and to this effect has addressed a circular to automobile owners requesting all the information which will be necessary in such case. It is desired to purchase both automobiles and motocycles, but the preference will be given to closed vehicles. The conditions of sale have been established on two general principles. First, the estimation of the value of the vehicle at the present time, according to an agreement between its owner and the Artillery Administration. Second, the fixation of the final value at the time of taking possession, taking into account the condition in which the machine is then found. The Artillery cannot require the delivery of the automobiles except in case of mobilization, and even in this case it reserves the right to purchase or not, as it may choose.

The Self-Propelled Traffic Association, of Liverpool, has organized a competitive test for heavy weight automobiles such as delivery wagons, tractors, etc., to commence on the 3d of June. The vehicles are divided into four classes. First, those weighing less than 2 tons empty and carrying a load of 1½ to 2 tons. The platform surface must equal 45 square feet, and the speed 8 miles an hour. Second, vehicles weighing empty 2 to 3 tons and carrying 2 to 5 tons of load. Surface 75 square feet and speed 5 miles an hour. Third, vehicles of at least 3 tons empty, without maximum limit of weight. They must carry more than 5 tons load, with platform surface of 95 square feet and speed 5 miles an hour. The fourth class has no limit of weight of the vehicle nor of the surface; the minimum load is to be 4 tons. Steam-propelled vehicles are to be represented for the most part, but it is expected that petroleum machines of the Panhard or Daimler types will be entered. The complete programme may be obtained from the secretary, Mr. Shrapnell-Smith, Royal Institution, Liverpool.

The automobile industry in Germany is making rapid progress, as is proved by the new machine of the Mercedes type which won the speed race for four-place vehicles at Nice. Its motor has four vertical cylinders, and will give no less than 35 horse power at 1,000 revolutions per minute. The ignition is on the Mayback system, using a magneto machine which gives a long spark. The admission valves of the cylinders are controlled by a regulator which permits of using from one to four cylinders at will. The motor is water-cooled, and uses only 1¾ gallons of water. In one test, over a run of 277 miles, not more than 1 per cent of the water was lost. The radiator has the form of a honeycomb, and contains as many as 5,800 tubes; the action of the radiator is assisted by an automatic ventilator, and the water is kept at a temperature of 50 degrees C. The motor has four speeds of 17, 28, 50 and 72 miles an hour. It is claimed that this latter speed may be attained after the machine is once well under way. The speed-changing gears are inclosed in a tight case. The truck is built of steel angle-iron; it is 23 inches from the ground, and the lowest part of the machine, 11 inches. The front wheels are 36 inches in diameter and the rear 45 inches, carrying pneumatics of 3.6 and 4.8 inches respectively. Three metallic brakes are provided, these having a novel system of water-cooling which proved of great value in the races at Nice. The steering is carried out by the hand-wheel and endless screw system, with, however, several important modifications. The machine is provided with roller bearings of the Lorenz system. A central lubricator, worked by the motor, oils the whole system. The motor is very li for its capacity, as it weighs, including flywheel , oil pump and water-cooler, only 524 pounds er details and illustrations of this interesting will be given later.

Engineering Notes.

Dr. W. Seward Webb, first vice-president of the New York Central and Hudson River Railroad, made the trip from San Francisco to New York in 79 hours.

A large gasholder has recently been built of cement concrete. Several tanks have been built on this system, one of them 53 feet in diameter and 25 feet deep (both inside measurement), with its upper part 10 feet above the natural surface of the ground. The walls are 30 inches thick at the bottom and 23 inches at the top.

A recent cold water paint calls for wet casein or milk curd, which is mixed with any suitable mineral base, dried and ground to powder. Some of the product is mixed with slaked lime and glue in the presence of water. This is then dried and ground to powder. The two main compositions are then mixed, the white and the colored pigment added, and the whole is diluted with water to a working consistency. The material is claimed to be waterproof, not to act upon the brushes, and may be diluted as required and always gives a uniform appearance, even if the entire surface is not treated at the same time.

The locomotive builders in Great Britain are at present experiencing a decided increase in trade. In addition to the large numbers of locomotives that are under construction for the home railways, Natal has just entered into contracts with the leading firms for the supply of 75 locomotives, 600 freight and 54 passenger cars. The government of Cape Colony are also placing their contracts for locomotives and rolling stock, for the greater part, with the British manufacturers. Belgium has also purchased several of the Dunalastair type of railroad locomotives, which have proved eminently successful upon their railroads.

It is said that the London War Office is contemplating the purchase of Dr. Barton's war balloon. It is of cigar shape, and has a platform and machinery suspended from the balloon. The propellers are driven by a high-speed motor, and there is a horizontal aeroplane for causing the balloon to ascend and descend, and at the rear there is a vertical aeroplane steering to the right and left. The difficulty which arises from moving the center of gravity is overcome by 2½-foot water tanks at each end, water being automatically pumped from one to the other as either end of the machine becomes heavier. At the end of the summer it is thought that the balloon will carry three persons at the rate of twelve miles an hour.

For some time past the London County Council have been conducting experiments in connection with the utilization of liquid fuel for fire engines. In 1899 a steam fire engine was equipped with the fittings necessary for liquid fuel consumption, as invented by the Clarkson & Capel Steam Car Syndicate. This engine has been maintained at one of the busiest stations, and the chief engineer has reported that the oil fuel meets the requirements admirably in every respect. Another existing steam fire engine is to be fitted with this oil fuel apparatus, and two large steamers that are now in course of erection will also be similarly adapted. It is stated that probably all the fire engines of London will be fitted with this apparatus.

Weston Howland, who is said to have been the first discoverer in America of a method for refining petroleum, died May 19, at Fair Haven, Mass. In 1860, when Secretary of the New Bedford Coal Oil Company, he began experiments with a view of getting a better illuminating oil than the crude material. He used a large kettle for a condenser, and succeeded in distilling the petroleum. The result was a mixture of oil and water. He then tried a milkpan and added alkalies and water to the crude product. He again produced a thick, ill-smelling liquid, and he put the pan and its contents away in his barn. The next day he found the problem had been solved; the rays of the sun had completed the process. He carried on the manufacture of refined oil for some time.

A new method of manufacturing Oriental carpets has been placed upon the market by an English syndicate, which has secured the entire rights from the inventor. It relates principally to the weaving of Turkish "piled" and "tufted" carpets, and the process embodies an advance as revolutionary as the inventions of Lord Masham. By hand about half a day is occupied in making a square yard of this textile fabric, but the Hallensleben power loom, as it is called, has a capacity of 35 square yards per day, and the material is equal in every respect to the finest hand-made Oriental productions. The loom is very ingenious in its arrangement, since the shuttle is dispensed with. The advantage of this system is that low-grade materials hitherto considered useless may be utilized, while a great economy is effected in time and power. The process of coloring the yarns for the design is another novel feature. This again is almost entirely accomplished by hand, and it is considered, in view of its simple character, that it may be adapted to other ramifications of the textile industry.

Electrical Notes.

The Attorney-General of Massachusetts has just rendered a decision in relation to the constitutionality of the bills authorizing street railways to carry merchandise in small packages. He finds that the bills are constitutional.

A French inventor has devised a way of awakening sluggards. Means are provided by which the weight of a person in bed makes an electric contact. A bell and a clock are placed in the circuit, and when the proper time has arrived the clock breaks the circuit and a bell rings until the sleeper is awakened and arises.

Consul Warner, of Leipzig, says that the long-distance telephone line connecting the cities of central Germany with Frankfort, Kalk, Mühlheim, Cassel, and Wiesbaden, in the western part of the country, has been opened for use of the general public. The charge for using this line is 1 mark (23.8 cents) for every three minutes to any one of the above-mentioned places.

Consul Grout, of Malta, notes that recent experiments in wireless telegraphy off the coast there have resulted in the successful transmission of a message 134 miles. While experimenting on a ship in the open sea, he adds, the operators were surprised to receive a message in Italian, asking as to the position of the ship. It afterward turned out that the message came from an Italian war vessel at Syracuse.

Westminster Abbey is to be illuminated with electricity. Gas has been used for a long time as an illuminant in the Abbey, but the gas sets up a chemical change in the limestone which is followed by disintegration, and a few weeks ago a small marble shaft fell from one of the windows in St. Andrew's Chapel, the iron pin which had sustained it for six hundred years having become corroded.

Next summer the Paris, Lyons and Mediterranean Company will operate an electric railway from Geneva to Chamouni, the time being 3½ to 4 hours. It is expected that the line will be in operation by July. The trip to Chamouni has heretofore been very long and tiresome, and it is probable that the new road will prove very popular to those who wish to economize time and money.

The number of inhabitants per 100 candle power of street illumination in some of the larger cities of the United States was given as follows by Mr. E. C. Jones, chief engineer of the San Francisco Gas and Electric Company, in a paper in The American Gas Light Journal: San Francisco, 40; Boston, 44; Cincinnati, 51; Chicago, 58; Cleveland, 65; Buffalo, 65; New York and Brooklyn, 86; Baltimore, 101; Omaha, 120.

Consul-General Guenther, of Frankfort, March 25, 1901, says it is reported from Brussels that the central African telegraph line connecting Brazzaville with Loango, on the west coast, has been completed, and that direct communication with Libreville may be had from any station of the English-Atlantic cable. The consul-general adds that the cable from Brazzaville to Stanley Pool, which is being laid to connect with the telegraph system of the Kongo State, will ultimately be extended to Lake Tanganyika, where it will form a conjunction with the German East African system.

The statistics collected during 1899 showing the damage done by lightning have been published by the Weather Bureau. The number of buildings damaged or destroyed by lightning in 1899 was 5,527. In addition to these 729 buildings caught fire as a result of the proximity to other structures that were fired by lightning. The approximate loss in 2,825 cases was $3,016,000; in 3,431 cases the amount of the loss was not reported, owing undoubtedly to the fact that the loss was small. A conservative estimate of the total loss by lightning during the year would be $600,000. The great majority of buildings struck by lightning were not provided with lightning rods. The same conditions prevailed in the preceding year.

Consul General Guenther writes from Frankfort, April 15, 1901: The association for the study of electric rapid transit railroads has issued its report for 1900. Among other things, it is stated that the elevated track of the military road between Berlin and Zossen, upon which experiments will soon be made, has been carefully inspected and strengthened. It is hoped to attain a speed of 125 miles per hour. Two cars will be employed, which are supplied with the strong machines required and will hold from forty to fifty passengers. The construction of the cars and their equipment differ, in order to make manifold experiments. Each car will have four motors, aggregating from 1,100 to 3,000 horse power; two three-axle movable trucks, and the necessary transformers, switching apparatus, etc. The cars will be 71½ feet long and will weigh about 90 tons. The effect of this speed on the elevated track will also be noted. The experiments will doubtless prove of the highest importance for the improvement of rapid-transit, although it may be found that the speed contemplated will not be feasible.

© 1901 SCIENTIFIC AMERICAN, INC.

PINE NEEDLES INDUSTRY IN OREGON.

BY ENOS BROWN.

The utilization of the pine needles of the yellow Oregon pine, botanically Pinus Ponderosa, is becoming an industry of considerable importance on the Pacific coast. Fifty years ago it was discovered that the extracts and products of the long, slender leaves of the pine possessed real efficacy in complaints of a pulmonary character. It is claimed that insomnia yields to the influence of the pungent odor, and asthmatics have found a real relief in partaking of the oil and in sleeping upon pillows stuffed with the elastic and fragrant fiber manufactured from the interior substance of the pine leaves. The illimitable forests of yellow pine abounding in the State of Oregon, with their accessibility to through lines of transportation, suggested to a German from the forests of Turingia the transfer of a lucrative business to the Pacific coast. In Germany the leaves never exceed two inches in length, while in Oregon they often exceed thirty inches, and average twenty. In the former country the forest laws are extremely strict and often prohibitive, obliging the maker of the product to use the dried leaves that have fallen to the ground and thus insuring an inferior and less effective quality of goods. In the Western State denuding the yellow pine of its leaves has been encouraged, the expert of the Forestry Commission having pronounced the process as beneficial. A tally kept of the weight gathered from a certain number of trees indicated that the crop taken in April weighed 650 pounds while that of the same trees in October yielded 775 pounds. Two crops are gathered yearly, the later one being always the largest. The leaves of the young trees are preferred, yielding a better quality of oil, it is said; though this fact is doubted. The leaves are stripped from the trees by women and men, who are hired for the purpose, and who are paid 25 cents a hundred pounds for the needles. Five hundred pounds is regarded as an average day's work. The leaves are picked into sacks and hurriedly sent to the factory. Exposure to the sun causes the leaves to wilt, and impairs the quality of the product. In picking, the thickest bunches of leaves are selected, and the scanty ones neglected. The vast quantity available, so far beyond any present demand, permits the picker to thus discriminate. The factory at which the essences and extracts of the needles are manufactured has a capacity for handling 2,000 pounds of leaves per day; but it is soon to be enlarged to about four times its present size.

In the extraction of pine oil, 2,000 pounds of green leaves are required to produce ten pounds of oil. The process is the ordinary one of distillation. In the manufacture of fiber the leaves pass through a process of steaming, washing, drying, etc., twelve in all, occupying four days. Two qualities are produced, first and second. The first, from which no oil has been distilled, is worth, upon the market, about ten cents per pound. The fiber is elastic, and the staple only little shorter than the green leaf from which it was made, and with strength sufficient to enable it to be spun and woven into fabrics. Mixed with hair, the fiber makes an excellent material for mattresses or pillows, and repose comes quickly when resting upon them. It is also used as a partial filling for cigars, imparting a flavor not the least disagreeable, and calming to the nerves. The oil extracted gives an agreeable flavor to candies. Toilet soaps are made, strongly impregnated with essential oil of pine needles.

The fiber itself, after curing, looks like a slender shaving of some dark wood, retaining its odor indefinitely. Insects abhor it on that account. It is said that the Oregon factory is the only one in the world outside of Germany.

STRIPPING THE PINE NEEDLES FROM THE TREES.

Mr. Quin, the borough electrical engineer of Blackpool, England, has perfected an invention by which all dangers from overhead electric wires are obviated. When a wire breaks, the current is switched off by a switch which is automatically released, and the wire thus rendered harmless. In the experiments which were carried out to prove the efficiency of the invention, three telephone wires were severed and fell upon an overhead electric wire. Instantly the automatic switch operated, and the inventor picked up one end of the broken wire.

The Age of Mammon.

Money-making is the axis around which the world's activities revolve. This is nothing new, adds Collier's Weekly, but probably it was never so true as it is to-day. On every side we see evidences that the world is in a sort of fever of acquisition. Wealth-getting has become a passion. The public press is filled with gossip about the great money-makers and their methods. Enormously rich men are held up as models. The acquisition of wealth is set before our eyes every day and every hour as an example of success. The Pierpont Morgans, the Henry C. Fricks, the Schwabs, Carnegies, and Hills are the modern ideals of our youth. Nor is this all. Science and art are becoming more and more the mere hand-maidens of industrialism. Our greatest scientific men are devoting their energies, not to pure science, not to their noble profession in its abstract or elementary form, but to those applications of it which result in some new economy of the world's work and in the formation of more immense stock companies, with bonds and common and preferred shares, dividends, and all the paraphernalia of modern financial operations on a big scale. The men who love science for science's sake are giving way to the Edisons, Teslas, Triplers, Pupins, Marconis, those wizards who by day and by night seek to wrest from nature some new and commercially profitable service to mankind. The number of patents taken out at Washington steadily increases, notwithstanding the predictions made not long ago that American inventiveness had reached its high tide. This is the age of materialism and of mammon, sure enough.

PLANT FOR DISTILLING OIL FROM PINE NEEDLES.

ALCOHOL AS FUEL FOR MOTOR CARRIAGES.

The champions of the alcohol motor scored another triumph in the Paris-Roubaix races, held on the 7th and 8th of April. The route passed through Pontoise, Beauvais, Amiens, Arras, to Roubaix, or a total distance of 167 miles. The competitors were divided into two parties; the first of these started from Paris and made the trip in two stages, with a stop at Amiens (89 miles), while the second party covered the whole distance in a single stage. The machines were divided into six classes, from quadricycles and voiturettes up to the heavy machines. The first party started from Paris on the 8th, commencing at 9 o'clock, from the Automobile Club building, on the Place de la Concorde, where a great crowd had assembled. The commission, including Messrs. Jeantaud and Forestier, gaged the reservoirs and took samples of the alcohol for analysis. The liquid was divided into three classes, pure alcohol, carbureted alcohol containing 75 per cent of alcohol, and carbureted alcohol at 50 per cent. The 50 per cent alcohol was used for the most part. On the first day there were 29 starters in the different classes. A similar start was made the next morning by the single-trip party (22 starters). The supply of alcohol could be renewed at Amiens, if necessary, and this was checked by a second commission. The following list gives an idea of the time and some of the best figures for consumption of alcohol: Class A, quadricycles, average weight 770 pounds—Osmont (De Dion machine), time 5h. 54m., consumption 5.85 gallons (50 per cent alcohol); Cousin (Werner machine), time 11h. 20m., consumption 2.73 gallons (50 per cent); Cormier (De Dion), 14h. 46m., consumption 1.89 gallons (50 per cent). Class C, Voiturettes, average weight 1,200 pounds—Theodore (Darracq machine), time 7h. 55m., alcohol (50 per cent), 4.68 gallons; Declercq (Renault machine), time 20h. 53m., alcohol (75 per cent), 5.93 gallons. Class D, light vehicles, average weight 1,450 pounds—Uhlmann (Decauville machine), time 6h. 38m., alcohol (75 per cent), 16.79 gallons; E. Brierre (Brierre), time 10h. 9m., alcohol (50 per cent), 7.85 gallons; Perez (Begot & Cail), time 12h. 8m., alcohol (pure), 8.57 gallons. Class E, vehicles, average weight 2,000 pounds—Girardot (Panhard & Levassor), time 7h. 12m., alcohol (50 per cent), 8.06 gallons; Manechal (Brouhot), time 10h. 25m., alcohol (50 per cent), 8.97 gallons; Le Blond (Gillet & Forest), time 12h. 40m., alcohol (pure), 10.01 gallons. Class F, heavy vehicles, average weight 2,800 pounds—Aristide (Panhard & Levassor), time 7h. 7m., alcohol (50 per cent), 8.25 gallons; Loysel (Bollée), time 7h. 45m., alcohol (50 per cent), 12.60 gallons. Class G, Industrial vehicles—Rost (Bardon machine, weight 3,170 pounds), time 15h. 33m., alcohol (pure), 12.74 gallons; Letellier (Richard machine, 4,830 pounds), time 16h. 24m., alcohol (75 per cent), 18.20 gallons. The weights given include the load carried by the machine. In spite of the bad condition of the roads, 48 of the 51 starters were able to finish the trip. The results obtained in the contest give an interesting series of data on the performance of the alcohol motor. The motor tests which are shortly to be made by the Automobile Club will throw additional light upon the subject. The performance of the Bardon, Gillet-Forest, Peugeot and Begot-Cail machines shows that pure alcohol may be used with success; the greater number of competitors used 50 per cent alcohol, however, and this seems to be in favor at present.

German Prize for Cooling Beer.

Consul-General Guenther, of Frankfort, March 21, 1901, informs the State Department that the German Brewers' Association has offered a first prize of $375 and a second prize of $125 for the best mixture for cooling beer. The composition must not be injurious to health nor cost more than 6d. (12 cents) for a cooling capacity equal to that of 100 pounds of ice, and must maintain the beer at a temperature of 45 deg. to 47 deg. F. Formulas should be sent to Mr. Johann G. Heinrich, Neue Zeil No. 68, Frankfort, Germany.

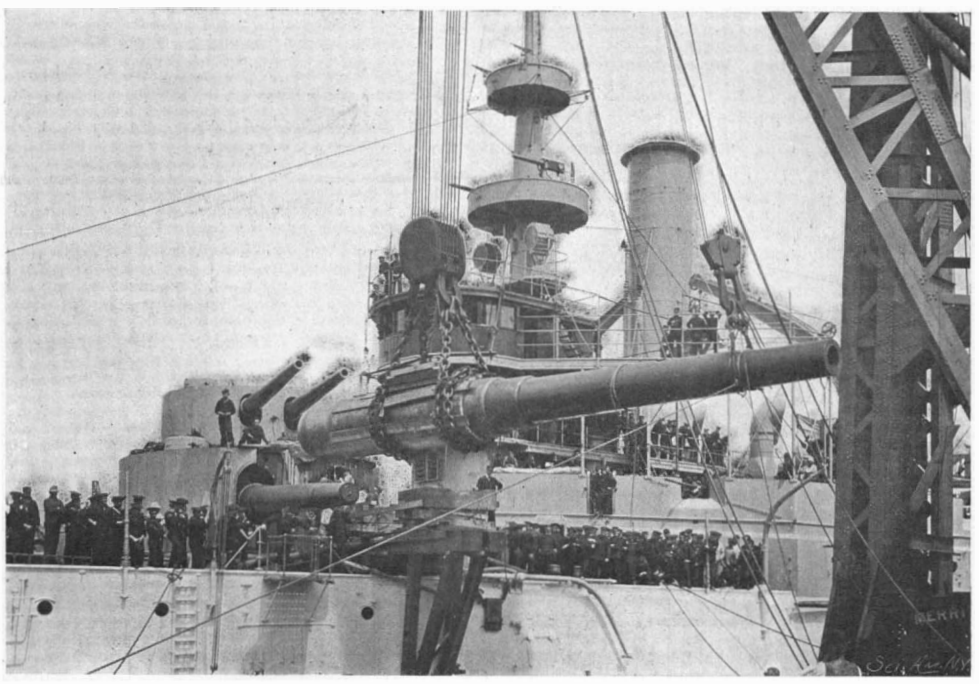
President Loubet and two of his Ministers made a trip in the "Gustave Zede" submarine boat at Toulon. They remained in the boat for an hour and a half, which moved along the surface and below the water.

© 1901 SCIENTIFIC AMERICAN, INC.

REMOVING THE DISABLED 65-TON GUN OF THE "KEARSARGE."

During the recent cruise of the "Kearsarge" in southern waters, and in the course of some target firing by the heavy guns, a shell exploded in the bore of the port 13-inch gun in the forward turret. As the fragments of the shell swept through the bore, they cut deep scores through the rifling which, in some cases, were over an inch in depth. The gun was condemned and a new one ordered in its place.

The "Kearsarge" is the first of our battleships to carry her main battery in double turrets, the 13-inch guns being carried in the lower turret, and the 8-inch in a secondary turret superposed above the 13-inch turret, in the manner shown in our illustrations. The removal of the damaged gun from a single-deck turret of the ordinary type would have been a comparatively simple matter, involving merely the removal of the 3-inch plating of the roof, and the lifting of the gun directly from the turret, breech first. But in the case of a double structure in which the upper turret with its pair of guns weighed over 170 tons, the problem of getting out the gun took on a very serious aspect, so much so, indeed, that it has been unofficially stated that the builders of the ship required $75,000 and three months' time in which to do the job. To remove the upper turret *en masse* would have been, if not impracticable, at least a very delicate operation, and it is more than likely that its removal would have necessitated its practical dismemberment, and its reconstruction after the new gun had been put in place.



THE 65-TON GUN BEING LIFTED BY THE FLOATING DERRICK FROM THE SHIP TO THE WHARF.

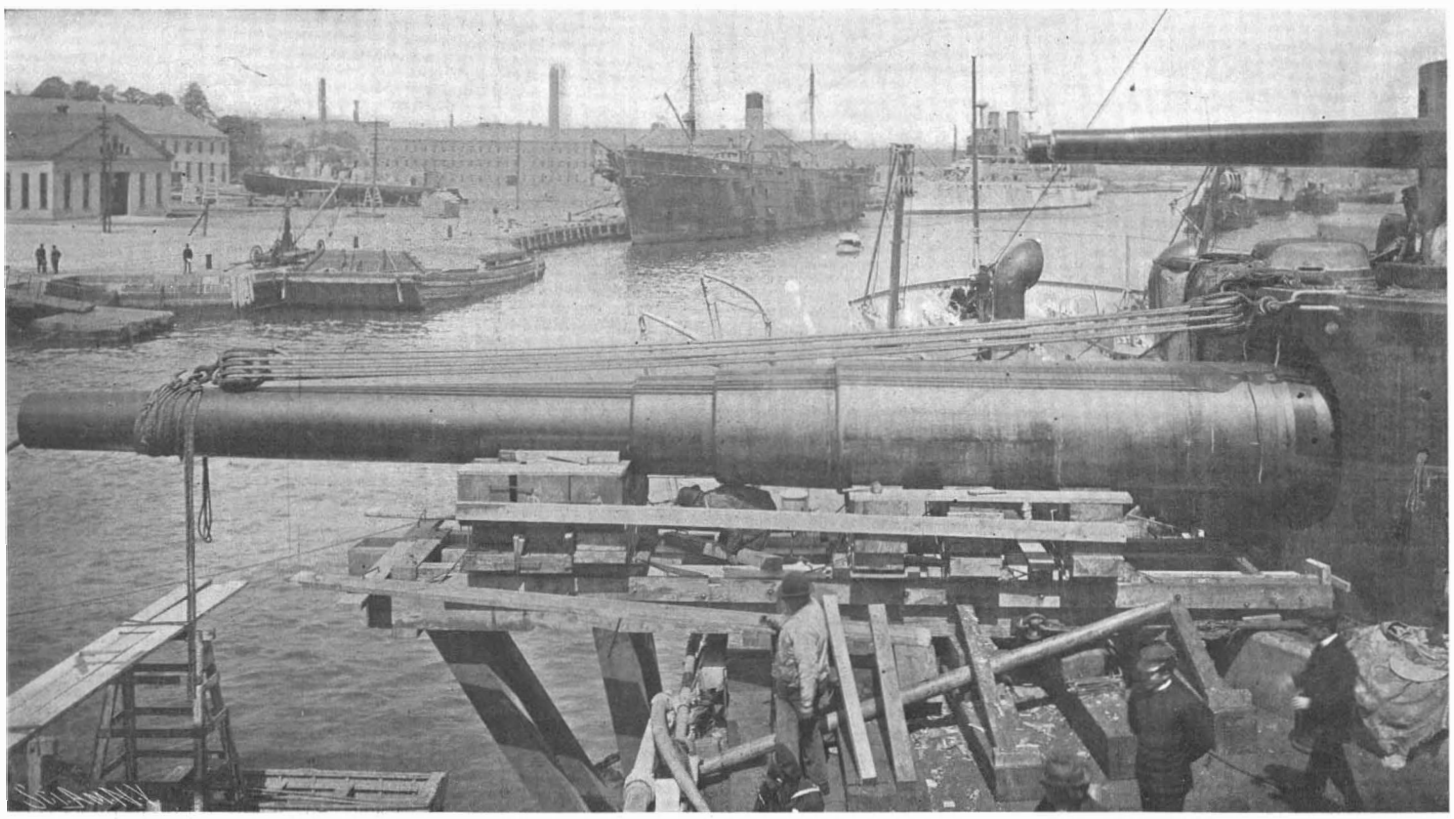
The "Kearsarge" was sent to the Brooklyn navy yard, and a careful survey of the turret was made by Naval Constructor Capps, to determine whether it would be possible to remove the gun without disturbing the superposed 8-inch turret. It was ascertained that by lifting the gun from its recoil sleeve, and doing a slight amount of chipping on the horizontal joints of the sleeve, the gun could be removed, without any further dismantling of the turret than the removal of two port-plates and some of the angle iron framing at the ports.

By the courtesy of the Department we are enabled to present three photographs, showing the methods by which the work was done. The first step was to remove from the interior of the turret the mantlet plates adjoining the gun port. Extra long wrenches were then used to unscrew the 3-inch bolts by which the port armor plates are fastened to the backing. Then the two plates themselves, which are 15 and 17 inches in thickness, and weigh respectively 35 and 28 tons, were picked up by a floating derrick and placed on the adjoining wharf. When the armor plates had been removed, the reverse angles which run around the port opening, and abut on the backing, were cut loose and removed. This left sufficient clearance to admit of the gun, which is 49 inches in diameter over the breech, being removed through the port. Had the 13-inch gun been of the old pattern, in which the trunnions form part of the gun itself, its removal by way of the gun-port would have been impossible; but fortunately it was of the latest pattern, in which the gun recoils within a sleeve, the trunnions being formed upon the sleeve and not upon the gun. The sleeve is formed in two halves which are joined in a horizontal plane. It was found that by unbolting the sleeve it was possible to raise the upper half to a vertical distance of 10 inches, or until it touched the roof of the turret. Then, by lifting the gun itself vertically through 5 inches, or half this distance, it was found that the gun could be drawn forward clear of the sleeve provided about 1¼ inches of metal was chipped away from the corners of a lip which projects inwardly at the forward end of the sleeve. These facts were determined by making a full-sized drawing of the gun and sleeve, and allowing about a quarter of an inch clearance after the corners of the sleeve had been removed. It should be explained that the forward lip of the sleeve, which is turned in toward the center for a depth of 2½ inches, is provided to secure the gun against counter-recoil after it has been fired, and the chipping was necessary simply upon the corners of this lip at the joint.

THE 15-INCH AND 17-INCH PORT-PLATES AFTER REMOVAL FROM THE TURRET.

While this work was being done inside the turret, a ways was laid from the turret port athwartship across the deck to receive the gun. This ways consisted of several lines of timber which extended out for several feet beyond the deck, its outer end being carried by heavy struts extending from the upper edge of the waterline belt of armor to the outer end of the ways. To prevent any distortion of the deck, due to the great load of the gun, heavy bracing was carried down from the main deck through to the protective deck. When everything was ready, the gun was lifted 5¼ inches from the sleeve by means of a special breech saddle, under which were two 90-ton hydraulic jacks, and by a third 90-ton jack placed beneath the chase of the gun outside of the turret. When the gun had been lifted clear of the sleeve, two special, sliding, saddles of metal, turned to the radius of the gun and the sleeve, were placed one at each end of the sleeve between the sleeve and the gun. The inner face of these saddles was babbited. The gun was now pushed out of the turret by hydraulic jacks, and as it passed on to the ways it was received by heavy wooden sliding saddles, one under the chase and another, 6 feet in length, at about the center of gravity of the gun. Obviously, with clearances so slight, it was necessary that provision be made for correcting the compression of the ways under the weight of the gun; and this was done by providing flat oak wedges, 10 inches wide, which were driven home from time to time beneath the wooden saddles to keep the axis of the gun up to its proper level. As soon as the gun was clear of the turret it was picked up by the 250-ton floating derrick and placed on the wharf. The new gun was then slung onto the ways, and was forced back into its place in the sleeve by means of hand-operated jacks, which were heeled against transverse timbers that had been provided for the purpose between the longitudinal timbers of the ways. It should be explained that the heavy tackle which is shown made fast near the muzzle of the gun and carried back to the turret was one of several measures of precaution taken against any possibility of accident.

Work was commenced on April 25 and the gun was in position and the turret plates restored by the 23d of May, the whole job being successfully carried through at a cost which will be within $10,000. We are indebted for our information to Naval Constructor Capps, under whose supervision this most interesting and difficult work was carried out.



THE INJURED 13-INCH GUN RESTING ON THE WAYS, OUTSIDE THE TURRET.

The illumination of Niagara Falls by searchlight will take place during the passage of all trains at night.

© 1901 SCIENTIFIC AMERICAN, INC.

Water in Ancient Rome.

In a remarkable address delivered before the Institution of Civil Engineers of London, its president, Mr. Mansergh, has destroyed the secular legend of the profuse distribution of water to the inhabitants of ancient Rome. Some extracts from his address follow, translated from a French version, and therefore not in his very words.

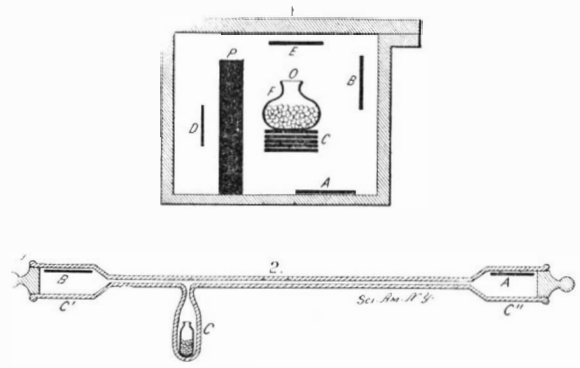
"We are used to hearing of enormous quantities of water brought to Rome by the great aqueducts which Frontinus has described and which existed down to the beginning of the Christian era. I had always thought that the figures given were much exaggerated," he says. "To-day it is evident that the volume of water so distributed was never properly measured, either at the inlets of the aqueducts or at their outlets, and no one seems to have understood the methods of calculation that will give the volume delivered when the section of the aqueducts and their slope are given."

The estimates of Frontinus were based on the discharge of a number of different openings of different sizes, and he takes no account of the difference between the discharge of 100 separate openings each an inch square, for example, and the discharge of one opening of 100 square inches. The unit of measure cited by Frontinus was a *quinaria*, a circular opening four square centimeters in area.

The discussions based on the data of Frontinus led to the conclusion that Rome was furnished with the enormous quantity of 1,400,000 cubic meters of water every twenty-four hours. These figures are absurd because they imply that the water flowed with velocities that have never been realized in practice. Moreover, we know from Frontinus and from Pliny that the nine aqueducts were rarely in operation at the same time, and having regard to all the data it follows that the daily supply of water was about 144,000 cubic meters, which would give about 144 liters (about 38 gallons) per head to the population of a million inhabitants. This supply will not seem excessive when we consider the great expense of water in the public baths and in the fountains. It must be remembered also that most of the houses were supplied by water carried by slaves, and that many wells and springs were also utilized in dwellings.

THE EXPERIMENTS OF M. CURIE.

M. Curie, in continuing his researches with regard to the rays given off by radium, has studied the remarkable phenomena of induced radio-activity. M. and Mme. Curie had already found that a substance, when placed in the neighborhood of the radiferous salts of barium, became itself radio active, and that this induced activity persists for a long time after the exciting body is removed. It diminishes, however, with time, at first rapidly, then more and more slowly. The phenomena of induced radio-activity have been also studied by Mr. Rutherford, who shows that air which has remained for some time in the neighborhood of oxide of thorium (a radio-active body) and then carried into a current to a distance, retains its property of communicating the radio-activity to other bodies. Mr. Rutherford explains these phenomena by supposing that the oxide of thorium gives off a special kind of emanation which is capable of being conveyed by the air, and that this is the cause of the induced radio activity. At present the question is far from being clear, and M. Curie, with M. Debierne, has made the following experiments in which he brings out some interesting facts. The phenomenon is much more strongly marked when it is carried out in a closed vessel. The active matter is placed in a thin glass bulb, *F* (see diagram), open at *O*, and placed in the center of a vessel completely closed. Three plates, *B*, *D*, *E*, suspended in different parts of the vessel, become active after one day's exposure. The plate, *D*, sheltered from the radiation by a lead screen, *P*, becomes active like the others. A plate, *A*, resting on the bottom, is made active upon the upper face, but not on the lower. In a series of plates in contact, *C*, placed against the bulb, it is only the exterior surface of the lower plate next the air that becomes active. All substances seem to take the activity in about the same way (lead, copper, glass, ebonite, paraffine, etc.). With a very active specimen of chloride of barium, the plates exposed for several days took an activity 8,000 times stronger than that of a plate of uranium of the same dimensions. When exposed to the air they lost the greater part of their activity in one day; the loss is much slower if the plates are left in the closed vessel, from which the exciting substance has been removed. Lastly, if the experiments are repeated with the bulb closed, no induced effect is produced in the plates. In a second experiment the small chamber, *c* (see diagram), containing the active body, communicates with the two others, *c'* and *c''*, containing the bodies, *A* and *B*, to be acted upon, by capillary tubes of diameter 0.004 inch and lengths 2 and 30 inches. The chambers were very small, and it was found that the excitation of *A* and *B* was produced as rapidly and as strongly as if they were placed in the same chamber as the exciting body. These phenomena were observed with different radio-active salts of barium and also with salts containing actinium; on the contrary, polonium compounds, even very active, did not produce the effect. As it is known that the latter do not emit rays which are deflected by the magnetic field, these two facts must be connected. It may be concluded, from these experiments, that the phenomenon is not produced by the ordinary rays of radium, but rather by extremely absorbable rays which act upon the air in immediate contact with the body. The induced activity is transmitted in the air by convection from the active body to another placed near it, and may thus pass even through capillary tubes. The activity, besides, tends toward a certain limit,



DIAGRAMS ILLUSTRATING THE EXPERIMENTS OF M. CURIE.

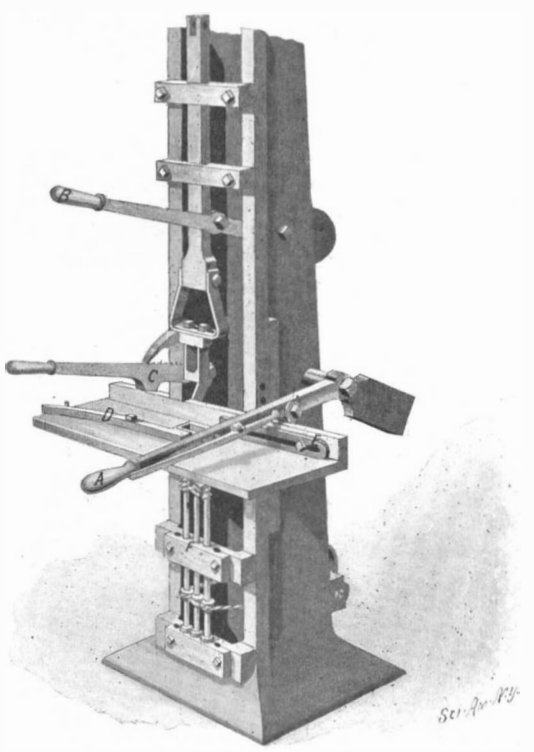
resembling an effect of saturation; this limit is higher as the exciting body is stronger. These experiments are in their first stage, and it is too soon to form a theory as to the cause of the action. M. Curie considers that these phenomena constitute one of the most important properties of radio-active bodies.

A PORTABLE MORTISING MACHINE.

The illustration herewith presented pictures a simple and cheap mortising machine invented by Mr. William J. Smith, of Detroit, Ore.

The machine comprises an upright frame on which a table, *D*, is vertically adjustable. To this frame a weighted table-adjusting lever, *A*, is fixed, by means of which the table can be raised and lowered. Arranged on the vertical backboard of the table is an adjustable gage-plate by which the work is engaged. Against the backboard the work is tightly held by a clamping-lever pivoted to the upper side of the table, which clamping-lever is in turn held in place by a pin inserted in a hole in the table. To prevent vertical movement of the work a second clamping-lever, *C*, is employed, which has a series of notches in any of which a locking-pawl may be engaged.

Movable in guides attached to the upright frame



THE SMITH MORTISING MACHINE.

is a chisel-carrying plunger operated by a hand lever, *B*, weighted so that it automatically moves upward after operation. The upper end of the chisel-carrying plunger may be engaged with a rocking-lever and the chisel operated by power if it be so desired.

Before cutting the mortise with the chisel, the work is bored by a gang of bits, *F*, mounted in the lower part of the upright frame and driven by belt and pulley. The table is moved down in order that the bits may come in contact with the work. After boring the table is moved up, and the chisel forced through the wood, making clean cuts at the sides and ends of the mortise. A protective shoe is employed to prevent the chisel from tearing the wood.

A Nice Place to Live.

The useful household magazine, Good Housekeeping, is responsible for the following:

"Imagine keeping a snake in the house to fill a cat's duties. That is what they do in Manila," says an American woman who has just returned from spending a year in the Philippines with her journalist husband. "The first night I spent in our own home was hot and smothering, so I lay wide awake, hoping for a breeze. Suddenly I heard a strange noise overhead. Manila houses are built of bamboo and are about as substantial as a bandbox, so one hears every rustle. I had listened to the scamper of a rat overhead, then came a queer noise like a stealthy slide. The rat gave a shriek of agony. I could hear the lash of the snake's tail and a terrible scrimmage all over the thin floor. They seemed to be rolling over each other and the snake was swallowing the rat. I heard it as distinctly as if I could see it. I shrieked louder than the rat had done, and in a moment every China boy in our establishment was in my room to see what had happened. Before I left Manila I grew as accustomed to finding a house snake on my floor as if it had been a cat. The house pests of the Philippines drive an American woman to distraction. Lizards are everywhere; you find them in your bed, in the dishes in the pantry, clinging to your gowns or napping in your bureau drawers. Some are no bigger than the chameleons we used to pet; others are a foot long. Ants of every size and sort simply inhabit everything you own. Every good housekeeper in Manila keeps the feet of her dining table standing in pots of oil. If you did not take that precaution one would be eating ants in every dish served."

Railroads of Roumania.

From official Roumanian sources, I learn, says Consul Hughes, of Coburg, that there are at present 1,932 miles of railway open to traffic, as against 1,550 miles in 1890 and 1,713 miles in 1895, while 72 miles are under construction and 360 miles under survey. The total expenditure on railways up to the present has been $140,000,000, including about $6,700,000 on the Cernavoda Bridge. Last year, the revenue was $8,992,761.55 and the working expenses about $7,299,750. A combination of lignite and petroleum is now largely used for fuel, a special apparatus having been invented for the proper consumption of the mixture. In 1896 only 2,200 tons of petroleum were consumed in the engines, but last year this rose to 15,200 tons; while the consumption of lignite rose in the same period from 17,200 tons to 67,000 tons. The railway administration recently initiated a weekly through service between Paris and Constantinople and Ostend and Constantinople via Bucharest and Constantza, and a daily service between Bucharest and Berlin via Lemberg.

A League Against the Rat.

Dr. Nashandi, a Japanese bacteriologist who has been visiting Chicago, declares that a league against the rat may be formed, says The New York Tribune. As a disseminator of disease this rodent works much more serious injury to human society than any already charged to his account. The malady with which these animals are most closely associated in the public mind is the bubonic plague. It is not uncommon for rats to die of that cause in a house before any human beings are attacked by it. Rats are such ramblers that it is possible for them to infect a whole neighborhood before the fact is discovered, and they even die in inaccessible places, so that their bodies remain hidden but active sources of infection for days and weeks.

The Current Supplement.

Probably the most interesting article in the current SUPPLEMENT, No. 1326, is "The New Edison Storage Battery," by Arthur E. Kennelly. The storage battery seems destined to work a revolution in electric automobiles. The project of the Krupp Works is described and a number of their large guns are shown. "Preventive Medicine—The City of Havana as a New Field for Its Application" is by Dr. Erastus Wilson. "The Bacteria Beds of Modern Sanitation" is by Eliza Priestley. "The Gods of the Filipinos" is by R. I. Geare. "Agriculture in Hawaii" is an interesting article. "The Distribution and Conversion of Received Currents" is begun in this issue.

Contents.

(Illustrated articles are marked with an asterisk.)

Alcohol as fuel for motor carriages 344
Cable systems in New York, last of the 338
Des Moines River viaduct* 340
Experiments of M. Curie* 346
Heavens in June 339
Inventions, recently patented 347
Jerome Park reservoir* 342
"Kearsarge," removing disabled gun from* 345
Life-saving apparatus (Germa 342
Mammon, age of 341
Model basin, U. S. experimental* 341
Mortising-machine, a portable 346
Navy yard work, high-class* 339
Notes and queries 347
Pan-American Exposition, opening of 338
Pine needle industry in Oregon* 344
Place to live, a nice 346
Prize for cooling beer 344
Railroads of Roumania 346
Railway viaduct over the Des Moines River* 340
Rat, league against the 346
Removing disabled gun of "Kearsarge"* 345
Rome, water in ancient 346
"Shamrock," the factor of safety in 339
Stonehenge, preservation of 340
Storage battery, new Edison 338
Supplement, current 346
Telephone business, present status of 340
Whirlwinds observed in Germany 340
Work at our navy yards, high-class 339

© 1901 SCIENTIFIC AMERICAN, INC.

RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

BAND-CUTTER AND FEEDER FOR THRESHING-MACHINES.—JOHN LUNZ, Sandcreek, Oklahoma Ty. In this machine the speed of the threshing-cylinder is regulated by the amount of grain deposited on the endless grain conveyer or carrier leading to the cylinder. A second conveyer is employed, arranged to swing backward in a vertical plane when a large amount of grain passes between it and the main conveyer. A clutch mechanism automatically regulates the speed of the swinging conveyer. A new arrangement of circular band-cutters has been devised, whereby the grain is spread as it is loosened from the sheaves.

PLOW.—WILLIAM C. POPE, Acme, Fla. The invention provides a plow for use in working cotton for the first time. The plow or cultivator embodies two disks which run on opposite sides of the row, together with devices whereby the angle of the disks to the row can be varied to make the disk run deep or shallow, as may be required.

DEVICE FOR OPERATING MARKERS OF CORN-PLANTERS. — JOSEPH CUNNINGHAM, Mattoon, Ill. Mr. Cunningham has provided a device adaptable to any corn planter, whereby the marker can be quickly raised by the foot of the driver and freed from any trash which may have been gathered. Thus, a plain mark is made during the planting, and the work of straight planting facilitated. The device is also serviceable in raising the marker to clear a rock or stump.

REPLANTER ATTACHMENT FOR CULTIVATORS.—JURGEN W. GRONEWOLD, Golden, Ill. By means of this simple replanting attachment, which can be readily applied to any cultivator and operated from the handle, a "set" of corn can be instantly and accurately dropped in a lost hill and added to one thinly planted during the cultivation of the field. At one movement of the operator's hand, a few seeds or grains are dropped on the ground, the furrow having been previously opened for the seed. The dropped seed is covered and rolled.

Engineering Improvements.

ROTARY ENGINE. — THOMAS CROSTON, Hoquiam, Wash. The rotary engine can instantly and automatically adjust itself to the requirements of the load and to the variation of steam pressure. Racing is prevented. The engine is not liable to slow down until the limit of its working power is reached. The cut-off can be varied from zero to full revolution. Efficient reversing means are provided. The engineer can ascertain the horse power under which the engine is running at all times.

ROTARY ENGINE.—JOHN D. R. LAMSON, Toledo, Ohio. Mr. Lamson's engine is simple in its construction and effective in its operation. The novel features of construction are to be found in a revoluble ring-shaped cylinder in which piston-heads swing. A fixed, hollow abutment is arranged in the cylinder and discharges the steam against the piston-head. The cylinder revolves around a fixed steam-chest connected with the abutment through an opening in the inner wall of the cylinder, to furnish steam to the abutment.

Electrical Apparatus.

CABLE.—JOHN D. GOULD, Brooklyn, New York city. The cable is to be used for conducting electric-light currents. The cable comprises not only a conductor for the working current, but also a fusible conductor designed for connection with a fire-alarm system. Thus the cable is converted practically into a thermostat throughout its entire length, or throughout the length of cable that may be placed in a building for electric-lighting purposes.

Miscellaneous.

TOOL-HANDLE. — JOHN A. HALL, Box 719, Aspen, Col. This tool-handle can be used with a hammer, an ax, a pick, and with other forms of heads. The handle is simple in construction and very cheaply manufactured.

PUMP-ROD GRIP.—JAMES E. FOSTER and CHARLES F. RICHEY, Franklin, Pa. The gripping device consists of a frame between the side pieces of which clamping-jaws are pivoted, thrown into gripping position by a pull-chain. The device is intended mainly to make connections between tackle-boxes and oil-well rod lines.

Designs.

HYDROCARBON LAMP. — JOHN W. MCCREA, Manhattan, New York city. The essential features of the design are to be found in bending the vaporizing tubes upward in a circle and in supporting upon them a globe to prevent the smoking of the ceiling. The support is ornamental in character. The design removes much of the hideousness of the ordinary hydrocarbon lamp.

FABRIC FOR DRESS BELTS. — JOSEPH RIEGELMAN, Manhattan, New York city. Ornamental figures are transversely coiled at the central portion of the strip of fabric, and V-shaped ornamental figures are marginally arranged. Both series of figures are embossed.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 715.—For a burner for coal oil or crude petroleum that will heat a water plant in house; plant carries 183 gallons.

For logging engines. J. S. Mundy, Newark, N. J.

Inquiry No. 716.—For manufacturers of wooden spigots with a key to operate.

TURBINES.—Leffel & Co. Springfield, Ohio, U. S. A.

Inquiry No. 717.—For manufacturers of cask making and stave dressing machinery.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 718.—For manufacturers of acetylene gas cook stoves.

WATER WHEELS. Alcott & Co., Mt. Holly, N. J.

Inquiry No. 719.—For manufacturers of patent fuel machinery.

Yankee Notions. Waterbury Button Co., Waterb'y, Ct.

Inquiry No. 720.—For manufacturers of match making machinery.

Dies & Special Machinery. Amer. Hdw. Mfg. Co., Ottawa, Ill.

Inquiry No. 721.—For manufacturers of hand power mixing and sifting machines.

Machine chain of all kinds. A. H. Bliss & Co. North Attleboro, Mass.

Inquiry No. 722.—For manufacturers of washing machines.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 723.—For implements for a fruit cannery.

Sheet Metal Stamping: difficult forms a specialty. The Crosby Company, Buffalo, N. Y.

Inquiry No. 724.—For manufacturers of ditching machines.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 725.—For manufacturers and dealers in aluminium goods for cooking purposes.

Rigs that Run. Hydrocarbon system. Write St. Louis Motor Carriage Co., St. Louis, Mo.

Inquiry No. 726.—For the addresses of the largest stone quarry companies in the United States.

Our Specialties:—Steel rims, steel tubes, steel boilers. The Standard Welding Co., Cleveland, Ohio.

Inquiry No. 727.—For manufacturers of crucible steel castings.

Ten days' trial given on Daus' Tip Top Duplicator. Felix Daus Duplicator Co., 5 Hanover St., N. Y. city.

Inquiry No. 728.—For a weighing or tallying machine to automatically weigh or count each coal tub in hoisting same.

SAWMILLS.—With variable friction feed. Send for Catalogue B. Geo. S. Comstock, Mechanicsburg, Pa.

Inquiry No. 729.—For machinery for making round soapstone and crayon pencils.

I want to secure the latest and best machinery for excavating and making peat fuel. J. Melvin, Box 773, N. Y.

Inquiry No. 730.—For manufacturers of cheap short distance telephone outfits in quantities.

Special and Automatic Machines built to drawings on contract. The Garvin Machine Co., 149 Varick, cor. Spring Streets., N. Y.

Inquiry No. 731.—For manufacturers or dealers in long distance telephones.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 732.—For machine for coiling No. 16 wire into ⅜ diameter coils of ½ to 3-16 mesh; machine to operate the same as weaving machine for wire mattresses.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

Inquiry No. 733.—For a machine for sharpening horse and barber's clippers.

Wanted.—The best "Horseless Carriage" there is in the market. Please quote lowest price for spot cash, and mail descriptive circular or catalogue, P. O. Box 764, Brooklyn, N. Y.

Inquiry No. 734.—For manufacturers of small castings in quantities.

Wanted.—A manufacturer to introduce the Fowler Pen on royalty (Pat. U. S., Can., Eng.), described in SCIENTIFIC AMERICAN, April 20, Fowler & Briggs, 118 Center Market, Washington, D. C.

Inquiry No. 735.—For parties to manufacture a special instrument.

Wanted.—General Superintendent for large manufacturing concern near New York. Must be an executive and organizer of ability and force. Give age, references, experience etc.—E. B. B., 16 and 18 Park Place, N. Y. City.

Inquiry No. 736.—For a lathe to turn ordinary bobbins for cotton mills.

Inquiry No. 737.—For a machine for turning and mortising shuttles.

Inquiry No. 738.—For dealers in machines of ¼ to ½ horse power operated by electric battery or gasoline (gasoline preferred).

Inquiry No. 739.—For manufacturers of the Blake stone crushing machine.

Inquiry No. 740.—For manufacturers of miniature railways.

Inquiry No. 741.—For manufacturers of machinery for evaporated fruits.

Inquiry No. 742.—For manufacturers of well drilling machinery.

Inquiry No. 743.—For blue-flame kerosene cooking stoves and ranges.

Inquiry No. 744.—For domestic cooking and kitchen labor-saving appliances.

Inquiry No. 745.—For manufacturers of oil filters.

Inquiry No. 746.—For manufacturers of steam hoisting engines for building work.

Inquiry No. 747.—For manufacturers of portable steam saws for cutting off timbers, etc.

Inquiry No. 748.—For a motor, wound by horse power, or otherwise, furnishing power to run light machinery on a farm.

Inquiry No. 749.—For the manufacturer of the "Clawson's Rotary" ice shaving machines.

Inquiry No. 750.—For manufacturers of radiators for automobiles.

Inquiry No. 751.—For manufacturers of marble cutting machinery.

Inquiry No. 752.—For manufacturers of gold mining machinery for gold placer work.

Inquiry No. 753.—For the manufacturer of aluminium sheets suitable for strainers.

Inquiry No. 754.—For manufacturers of aluminium rivets.

Inquiry No. 755.—For manufacturers of rapid photographic instruments that will photograph, develop and finish entirely in the shortest possible time, or half a minute, if possible, for making abstracts of legal records in a county seat.

Inquiry No. 756.—For manufacturers of autographic supplies.

Inquiry No. 757.—For manufacturers of a complete plant for cleaning carpets, or machinery therefor.

Inquiry No. 758.—For manufacturers or dealers in large colored photographs of scenery of Switzerland, the Alps and the Rocky Mountains.

Inquiry No. 759.—For manufacturers of thermometers for measuring temperatures from 300° to 1000° Centigrade.

Inquiry No. 760.—For manufacturers of machinery, tools and material for manufacturing traveling bags, dress suit cases, etc.

Inquiry No. 761.—For manufacturers of small porcelain-lined water tanks for refrigerators.

Inquiry No. 762.—For manufacturers of ice harvesting machinery.

Inquiry No. 763.—For manufacturers of machines for blanching and grinding, or otherwise preparing peanuts.

Inquiry No. 764.—For manufacturers of feather duster machinery.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(8194) A. C. writes: 1. I read the following extract from Ganot: "He who makes choice of Coulomb's law to connect the electrical measurements with the 'absolute units' will constitute the system of absolute electrical units known as 'electrostatic system.' If the law of electrodynamic actions, expressed by the Ampere formula, be chosen, the electrodynamic system will be formed. At last, he who prefers the law of the electromagnetic actions expressed by the Laplace formula will form the electromagnetic system of the absolute electrical units." Please be so kind as to give me a notion of: 1. Coulomb's law. A. The formulas for which you inquire are mostly given in Ganot, from whom you quote. Coulomb's law is that the force between two charges is directly as the product of the quantities and inversely as the square of the distances between them. 2. Of the law of the electrodynamic actions expressed by the Ampere formula. A. Ampere's formulas refer to the motion produced by currents in relation to the direction of their flow, by their attractions and repulsions upon each other. They may be found in any advanced text book of physics. 3. The law of the electromagnetic actions. A. The electromagnetic actions of currents upon each other are given at length in Ganot, 15th American edition, sec. 999. As they cover more than half a page of fine type, we cannot spare space to reprint them. 4. The formula of Laplace. A. We are at a loss to say what formula of Laplace is referred to. 5. You have a solid body animated by the rotary movement around an axis. There are the centripetal and the centrifugal forces; the molecular attraction is in equilibrium with the centrifugal force, and we have the equality of action and reaction. But suddenly, the body breaks to pieces; the centrifugal force has become too great; the molecular attraction has been overcome. How can it be maintained in that case, that the action is always equal to the reaction, and vice versa, according to the principles of mechanics? A. You are in error in your conception of Newton's third law. It states the mutual action of two bodies upon each other, and not the action of a single body in motion. While the body is held together, the action and reaction of its parts are as you state them; but when the body breaks to pieces there is no longer any reaction against its motion. If there were but one body in the universe, there could be no reaction. A reaction is always between two bodies, and the law is better stated: "The mutual actions of any two bodies are always equal and oppositely directed." (Barker).

(8195) C. W. S. writes: A substance called "Sencone" is stated in Thorp's "Dictionary of Applied Chemistry," to be made by heating crystalline silicon to redness in chlorine and passing the compound formed into water. It claims that this substance when heated glows with a bright light and deposits silica. Can you kindly inform me if this means that this glow, when heated, is permanent? A. The heating of the compound of silicon which you describe produces its decomposition with light. When the action is over the light will, of course, cease. There is no way to produce permanent light.

(8196) J. L. P. writes: I would be glad if you would give me a rule for finding the trial figure in the divisor in extracting square root. A. To extract the square root of any number separate the number into periods of two figures each, counting each way from the decimal point. Fill the lowest period of the decimal part with a cipher, if it contains but one figure. Find the largest square in the highest, or left-hand period. Place the root of this square as the first figure of the root, and subtract the square from the highest period of the number. To the remainder annex the second period of the number as a dividend. Multiply the root already found by two, and place the product as the *trial* figure in the divisor. Divide all of the dividend except its lowest figure by the trial divisor for the next figure of the root. Write this both in the root and as the lowest figure in the divisor. This is called the *complete divisor*. Multiply the complete divisor by the last figure of the root, subtract the product from the dividend, bring down the next period of the number, and proceed as before till the entire root is found. This rule is simply the statement of a formula of algebra in words:

$$a^2 + 2ab + b^2 = (a + b)(a + b).$$

a represents the first figure of the root, and b the second figure. An example of the mode of using the rule is given:

```
                          6,34, .20 (25.18
                                     4
Trial figure 4          ------------
                          45)234
                                   225
Trial figures 50        ------------
                          501)920
                                   501
Trial figures 502       ------------
                          5028)41900
                               40224
```

This may be carried out to any desired number of figures.

(8197) A. F. D. asks: 1. What effect, if any, has the adding of bichromate of potash solution? Does it give solution more strength or lessen it? Example: If rule gives 3 ounces sulphuric acid and 3 ounces bichromate potash and water, and you add 5 ounces instead of 3 ounces potash, what does it do? A. Adding more bichromate to a solution makes it stronger in bichromate, relatively weaker in the other ingredients. If the formula is properly made up, no change should be made in its proportions. The chemist who made the formula knew what quantities to use so as to have the various ingredients do their proper work. 2. I have small electric motor, about one-half man power; would like directions for making battery to run same, and number of cells. I am going to use motor to run small foot drill and emery wheel. A. A battery is described in SUPPLEMENT No. 792 which is just the thing for your purpose.

(8198) R. K. F. asks: 1. Will you kindly inform me of a firm selling aquarium cement? A. See our advertising columns, or Manufacturer's Index, which is sent upon application. 2. Have you a recipe? A. Mix equal parts of gutta percha and yellow pitch. Heat carefully, stir well, and apply to the heated glass while hot. 3. What is the lowest voltage (direct current) at which the electric arc may be operated? A. The drop in the arc is 45 volts. Any excess over this in an open arc must be taken up by a resistance. 4. Can a 10-inch spark (induction coil) be produced with a pressure of 48 volts? A. Yes. 5. Can chalk be made incandescent? A. Yes, by the oxy-hydrogen jet, just as the lime is in a calcium light. 6. At what temperature does incandescence occur? A. The latest conclusion is that an electric light carbon emits visible radiations at 734° F. Iron sends out light at 713° F., and gold at 783° F. The first light seen is gray, and the spectrum extends from the point of greatest luminosity to both ends of the spectrum. 7. At what temperatures do platinum and German silver melt? A. The latest figures for the melting point of platinum are 5,846° F. Previously the figure given was 3,427° F. German silver is a substance of no fixed composition. Its melting point thus varies, and no fixed point can be given.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending

May 21, 1901,

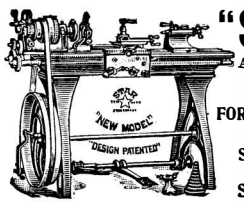
AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Abrading mechanism, J. M. Nash	674,384
Acetylene generator, J. A. Mosher	674,610
Air brake, A. J. Brislin	674,493
Air brakes, automatic pressure retaining device for, J. R. Ide	674,734
Alkali and halogen gas, apparatus for the production of caustic, C. E. Acker	674,691
Amalgamator, J. Y. Byers	674,624
Anchor, D. M. Hastings	674,839
Animal trap, A. M. Carlsen	674,551
Animal trap setting apparatus, F. D. Justo	674,773
Antiseptic apparatus, W. M. Kelso	674,701
Armature core, H. E. Heath	674,505
Asphalt pavements, composition for, J. H. Amies	674,823
Auger attachment, earth, F. R. Wren	674,549
Automobile vehicle, J. C. Anderson	674,372
Axle box, vehicle, H. D. Smith	674,817
Ballot box, C. E. Gierding	674,404

(Continued on page 348)

© 1901 SCIENTIFIC AMERICAN, INC.



"Star" Foot and Power Screw Cutting Automatic Cross Feed **Lathes**

FOR FINE, ACCURATE WORK

Send for Catalogue B.

SENECA FALLS MFG. CO.
695 Water Street,
Seneca Falls, N. Y., U. S. A.

ARMATURE WINDING, RIGHT AND Left Handed.—An important paper for all amateurs. 17 illustrations. SCIENTIFIC AMERICAN SUPPLEMENT, No. **1139**, price 10 cents. For sale by Munn & Co. and all newsdealers. Send for catalogue.

ENGINE & FOOT LATHES. MACHINE SHOP OUTFITS. TOOLS AND SUPPLIES. CATALOGUE FREE. SEBASTIAN LATHE CO. 120 CULVERT ST. CINCINNATI, O.

A Tool Inventory

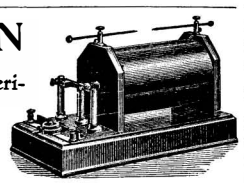
so comprehensive that it includes most every tool at present used by all trades and professions is

Montgomery & Co.'s Tool Catalogue

a book of 510 pages, illustrated, well printed, pocket size, and mailed to any address on receipt of 25 cents.

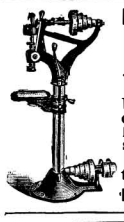
MONTGOMERY & CO.,
105 Fulton St., N. Y. City.

INDUCTION COILS for experiments in X rays and other electrical work.



☞ *Catalogue Free.*

E. S. RITCHIE & SONS, BROOKLINE, MASS.



FOR LIGHT AND MEDIUM WORK this new 14 inch

B. F. BARNES

Upright Drill is several laps ahead of any other drill on the track. It will drill from 1/16 of an inch up to ¾ of an inch and is a strong, well built, durable tool.

It doesn't cost a whole lot either. Details are yours for the asking.

B. F. BARNES COMPANY, Rockford, Ill.

Prices reduced for Spring & Summer

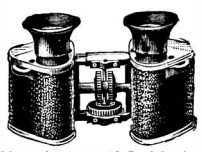
Jaeger PURE WOOL UNDERWEAR

Send for Illustrated Catalogue.

New York: 16 West 23d Street. 157 Broadway.
Brooklyn: 504 Fulton Street.
Boston: 230-232 Boylston Street.
Philadelphia: 924 Chestnut Street.
Chicago: 82 State Street.

Agencies in all principal cities.

NEW BINOCULAR.



(The Triëder.)

Small as an opera glass. More powerful than the largest field glass. *Send for Circulars.*

QUEEN & CO.

Optical and Scientific Instrument Works,

1010 Chestnut Street,

NEW YORK: 59 Fifth Ave. PHILADELPHIA, PA.

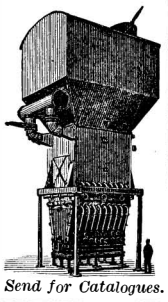
ELECTRIC AUTOMOBILE. — DIRECTIONS, with many illustrations, for making a complete machine from two bicycles are given in SUPPLEMENT No. **1195**. The motor and battery are also treated of in detail. Price 10 cents. For sale by Munn & Co. and all newsdealers.

HOT BLAST

WATER JACKET FURNACES FOR **COPPER ORES.**

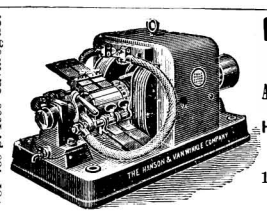
MATTE from SULPHIDES AT ONE OPERATION.

UNION IRON WORKS,
San Francisco, Cal., U. S. A.



Send for Catalogues.

Send your business card for 1901 catalogue.



NICKEL AND **Electro-Plating** Apparatus and Material.

THE Hanson & VanWinkle Co.,
Newark, N. J.
136 Liberty St., N. Y.
30 & 32 S. Canal St Chicago.

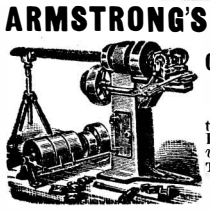
Chemistry of Manufacturing.

Testing, Perfecting, Introducing and Disposing of Chemical Patents, Processes, Products, Formulas, etc.

Utilization of Wastes and Unapplied Substances. Improvement and Invention of Processes and Products. Reduction of Manufacturing Costs. Experimental Investigation of Technical Problems. Working out Formulas for Manufacturing Technical Articles. Research Work for Manufacturers.

PETER T. AUSTEN, 52 Beaver Street, New York.

ARMSTRONG'S PIPE THREADING —AND— **CUTTING-OFF MACHINES**



Both Hand and Power. Sizes 1 to 6 inches.

Water, Gas, and Steam Fitters' Tools, Hinged Pipe Vises, Pipe Cutters. *Stocks and Dies universally acknowledged to be* THE BEST. ☞ *Send for catalog.*

THE ARMSTRONG MFG. CO.
Bridgeport, Conn.

Ballot box, T. E. McNulty	674,514
Band cutter and feeder, Eustice & Koeper	674,367
Barrel drying apparatus, Weber & Jewett	674,659
Bath tub or bathing apparatus, T. Mabbitt	674,704
Battery. See Storage battery.	
Bed, W. D. Olney	674,795
Bed bottom, spring-mounted, G. Brand	674,364
Bedstead attachment, C. E. Rice	674,585
Bedstead, extensible, Bergman & Renard	674,725
Bedstead fastening, G. C. Luther	674,630
Bicycle air pump, J. Furbow	674,829
Bicycle fork, J. J. Slevin	674,744
Bicycle post, Watson & Price	674,528
Bicycle support, E. Major	674,784
Billet making machine, W. B. Hughes	674,769
Bleaching fabrics, Cross & Parkes	674,759
Blower, R. Berg	674,832
Blower, rotary, T. W. Green	674,536
Boat, life saving, C. Buckel	674,597
Boilers, machine for rolling corrugated headers for tubular, C. Harter	674,555
Boot or shoe welt, W. B. Arnold	674,831
Boring machine, S. L. Harwood	674,699
Bottle attachment, non-refillable, Heller & Ives	674,441
Bottle cap, metal, H. S. Brewington	674,692
Bottle filling machine, D. Wiser	674,849
Bottle neck forming machine, A. J. Rudolph	674,519
Bottle, non-refillable, McCord & Adams	674,791
Bottle stopper, S. M. Goldberg	674,502
Bottle, testing, C. Wagner	674,717
Bottle washer, H. Muller	674,511
Bowling alley, P. J. Riddell	674,797
Brake lever, J. H. Baker	674,592
Brake mechanism, C. W. Sponsel	674,745
Brake shoe, Gilman & Brown	674,679
Brush case, tooth, L. Eaton, Jr	674,499
Brush cutting machine, L. Nilson	674,425
Button or stud, J. Campbell	674,730
Buttoner, collar or cuff, J. F. McGee	674,739
Buttonhole cutter gage bar, F. H. Farnham	674,828
Cabinet, kitchen, R. J. Cole	674,758
Cable grip, C. Noble	674,708
Cake candle holder and dish, birthday, J. A. Earl	674,457
Camphorate of phenyldimethylpyrazolon and making same, acid, B. Reuter	674,686
Camphorate of phenyldimethylpyrazolon and making same, neutral, B. Reuter	674,687
Can. See Ice can.	
Can screw cap, G. Wilcox	674,530
Canals, etc., controlling works for, O. Guthrie	674,629
Car brake, J. Daley	674,603
Car brake, railway, W. W. Annable	674,824
Car coupling, F. M. Kreitz	674,736
Car lighting, R. M. Dixon	674,401
Car truck brake, high speed railway, G. J. Capewell	674,365
Car ventilating apparatus, T. H. Mastin	674,705
Carbonating and delivering liquids, apparatus for, Birnie & Gay	674,492
Carbureter, T. McCormick	674,812
Card wiring machine, W. W. Fuller	674,369
Carriages, power transmitting means for horseless, J. C. Blevney	674,665
Cart and chair, combination, G. A. Long	674,783
Cartridge, C. A. Bailey	674,751
Cash check device, manifold continuous, S. W. Shirck et al	674,566
Cash register guard attachment, E. F. Haenchen	674,381
Chain coupling machine, W. W. Willson	674,547
Chair head rest, F. Ritter	674,565
Check and seal, combined baggage, E. Tyden	674,526
Check for hotels, control and guest's pay, M. Kuhn	674,777
Checking, means for, J. H. McTague	674,654
Cheese cutting apparatus, E. G. Thunell	674,803
Chuck, lathe expansion, A. J. Schuster	674,475
Churn, J. F. Baugh	674,393
Cigar or cigarette, self-lighting, P. Gaudagnini	674,406
Cigarette machine, pocket, L. Lee	674,845
Circuit controller, C. Hoffmann	674,840
Clasp, A. L. Lundburg	674,847
Closet or urinal trap, L. M. Hooper	674,681
Clothes drying rack, C. W. Dauber	674,673
Clothes pin, R. L. Horsley	674,841
Clothes rack, C. Launer	674,779
Clothes rack and shelf, R. J. Riley	674,586
Clover buncher, T. S. Pearson	674,813
Coffee or tea pot attachment, G. A. Darden	674,456
Coffins, machine for stamping metal, C. M. Drennan	674,647
Connecting rod, H. C. Clay	674,625
Connecting rod, C. H. Howland-Sherman	674,842
Conveyor, J. C. Hoshor	674,382
Conveyor, D. J. Sheldrick	674,480
Cooking apparatus, steam, R. C. Payson	674,685
Cork, S. H. M. Seib	674,522
Corset, H. Fedra	674,459
Couch support, F. A. Millikan	674,788
Coupling, H. G. Volkmar	674,389
Cover, cooking vessel, J. H. Wilson	674,569
Cow tail attachment, R. S. Thornton	674,543
Crate or coop, folding or knockdown, White & Miller	674,805
Cream separator, J. D. Arras	674,623
Cue tipper and straightener, C. J. Dorticus	674,732
Cultivator, W. F. Hartig	674,408
Cultivator, V. G. Skeen	674,481
Cultivator center foot, J. E. Greathouse	674,405
Cultivator, gang, R. C. Buckley	674,755
Cultivator, sulky, O. C. Geines	674,607
Curtain pole gripping device, F. R. Dingos	674,627
Cutlery blank, J. R. Patterson	674,741
Damper controlling apparatus, T. F. Maher	674,631
Dental bridgework, J. B. Morgan	674,449
Dental crowns, swaging, Brewer & Burfeind	674,834
Dental plates, means for swaging metal, N. C. Leonard	674,581
Dental tongue holder and drain tube, J. A. W. Lundborg	674,650
Dental tool for filling teeth with amalgam, P. J. Friedrichs	674,761
Diffusion process, C. Steffen	674,483
Distilling wood for the manufacture of charcoal and saving by-products, C. W. Bilfinger	674,491
Door sping, G. W. Geran	674,678
Drawer controlling device, furniture, I. N. Weitzel	674,622
Dredging dipper handle, P. Howard	674,417
Drier. See Hair drier.	
Drill, P. Pearson	674,428
Drinking glass holder, R. Metz	674,787
Drop seat, J. P. Stevenson	674,688
Drum, L. P. Zeidler	674,550
Dust guard, J. A. Perkins	674,635
Dust pan, A. Olson	674,516
Eaves trough extension bracket, P. Baran	674,663
Educational appliance, S. J. Talbot	674,486
Electricity, apparatus for collecting atmospheric, A. Palencsar	674,427
Electrode framing mold, R. J. Gulcher	674,407
Elevator, J. F. Sanderson	674,473
Enameling metal surfaces, J. H. Hines	674,506
Energy accumulating and storing apparatus, A. de Castro	674,825
Engine. See Explosion engine.	
Engine, J. H. Mount	674,706
Engine speed regulator, explosive, H. J. Hartig	674,580
Envelop, safety, Mann & Higbee	674,785
Exercising device, F. W. Baker	674,391
Expansion bolt, J. C. Summerer	674,715
Explosion engine, Kopp & Preston	674,421
Extension table, W. Kopp	674,420
Eyeglass or spectacle fitting, P. Moews	674,448
Eyeglasses, folding, A. Wienrich	674,690
Eyelet, R. L. Cooke	674,435
Faucet, H. Kupsch	674,844
Feed mill, N. Burr	674,599
Feed water heater, J. E. Schlieper	674,638
Fence post, J. F. Martin	674,538
Fence strain end or corner, wire, M. D. Cummings	674,694
Fence, wire, J. W. Tracey	674,804
Fertilizer distributer, B. F. Robinson	674,429
Filter, C. R. Harris	674,763
Firearm single trigger mechanism, A. E. Lard	674,508
Firearm single trigger mechanism, F. E. Jaeger	674,843
Fire box lining support, C. L. Beers	674,724
Fire escape, C. R. Porter	674,584
Fire extinguisher, A. W. Edmands	674,827
Fireproof walls in wooden buildings, apparatus for making, J. A. McNamee	674,616
Flag pole revolving truck, McGrath & Lawlor	674,792
Flue cutter, De Bolt & Hinde	674,553

(*Continued on page 349*)

AUTOMOBILE PARTS.

IF YOU ARE BUILDING AN AUTOMOBILE, WE CAN SUPPLY YOU WITH PARTS AND FITTINGS.

IN OUR SEVEN FACTORIES WE MAKE RUNNING GEARS, TOOL STEEL BALLS, STEEL RIMS, STEEL STAMPINGS, CHAINS, SHEET STEEL AND FORGINGS. ALL FOR AUTOMOBILE CONSTRUCTION

QUOTATIONS ON APPLICATION.

THE AUTOMOBILE & CYCLE PARTS CO.
CLEVELAND, OHIO.

American Sheet Steel Company
Battery Park Building
New York
Manufacturers of all varieties of
Iron and Steel Sheets
Black and Galvanized
Plain and Painted
Flat, Corrugated and
"V" Crimped

Apollo Best Bloom Galvanized Sheets
W. Dewees Wood Company's
Planished Iron
W. Dewees Wood Company's
Refined Iron
Wellsville Polished Steel Sheets

CREST MFG. CO.

CAMBRIDGEPORT, MASS.

3 to 5 H. P. MOTORS

CREST Sparking Plug

Coils Batteries Carburetors

THE AUTO-CARBURETTOR

made upon a new principle furnishes a reliable explosive mixture. Easy ignition and greatest expansion. No pump required. Uses any grade of gasoline with no waste. Especially adapted to automobile and cycle motors. Our customers say it is the best Carburettor in the market. We make also the **Register Valve** for controlling the flow of gasoline or other fluids. Write us for prices and booklet on Carburettors.

Gasoline and Steam Engines and Automobiles built to order and repaired.

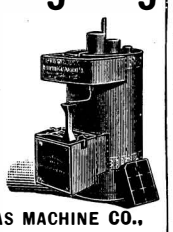
The Avery & Jenness Co., 60 South Canal St., Chicago.

GERE GASOLINE ENGINES

SIMPLEST BOAT ENGINES MADE
CABIN AND OPEN BOATS
ENGINE CASTING'S, BOAT FRAMES
GEO. H. GERE YACHT LAUNCH WKS.
GRAND RAPIDS, MICHIGAN.
NEW CAT FOR 4 STAMPS

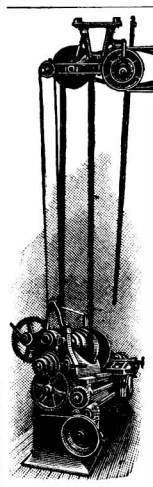
Acetylene Gas Lighting

Reduced to the most Efficient, Safest, Simple and Economical Use.



We guarantee our machines perfectly automatic in action, to extract all the gas from the carbide, and absolutely no over production or loss of gas. Approved by the various Boards of Fire Underwriters. Standard sizes 10 to 150 lights. Exclusive territory given to responsible agents. Correspond with

NIAGARA FALLS ACETYLENE GAS MACHINE CO.,
Niagara Falls, N. Y. and Canada.



Powerful, Responsive, Durable and Efficient.

"The Reeves" Variable Speed Countershaft

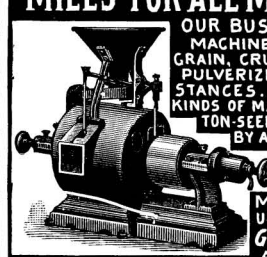
for securing any speed without change of belt or loss of time. Especially adapted for all kinds of iron-working Machinery, Iron Lathes' Planers, Boring Mills, Shapers, etc.; Cement Machinery, Experimental Machinery—in fact all kinds of machinery requiring a change of speed. With it a large increase and a better grade of work can be produced.

☞ *Send for handsomely illustrated catalogue "S. A." free.*

REEVES PULLEY CO.
COLUMBUS, IND., U. S. A.

RUBBER STAMP MAKING.—THIS article describes a simple method of making rubber stamps with inexpensive apparatus. A thoroughly practical article written by an amateur who has had experience in rubber stamp making. One illustration. Contained in SUPPLEMENT **1110**. Price 10 cents. For sale by Munn & Co. and all newsdealers.

MILLS FOR ALL MATERIALS.



OUR BUSINESS IS TO MAKE MACHINERY FOR GRINDING GRAIN, CRUSHING ROCKS AND PULVERIZING ALL HARD SUBSTANCES. WE HANDLE ALL KINDS OF MATERIALS FROM COTTON-SEED TO ROOTS AND HERBS, BY AN UNEXCELLED PROCESS. IF YOU WANT ANY KIND OF A MILL OR GRINDING MACHINE, COME TO US AND YOU WILL GET THE BEST AND STILL SAVE MONEY.

DEAL WITH US ONCE AND YOU WONT CHANGE.
ESTIMATES FREELY FURNISHED.
SPROUT, WALDRON & CO.
SEND FOR CATALOG No. 4.) MUNCY, PA.

WILLIAMS' SHAVING STICK

THE ACME OF LUXURY

THE PINNACLE OF PERFECTION

SOLD EVERYWHERE — BY MAIL 25c.
IF YOUR DEALER DOES NOT SUPPLY YOU.
THE J. B. WILLIAMS CO.
GLASTONBURY CONN.
LONDON - PARIS - DRESDEN - SYDNEY.

A PLEASURE LAUNCH

Must have speed, combined with safe and reliable power; she must be built upon lines of grace and beauty. The "Recreation" covers these requirements. In its use you are tranquil in mind, body and estate, no fixing and figuring upon "her going." Minimum weight, maximum power, economy of maintenance. Throttle speed regulator. Write for circular "S."

WESTERN GAS ENGINE CO. - - MISHAWAKA, IND.

SEND 10¢ FOR 126 PAGE ILL. CATALOGUE.

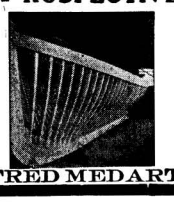
GEARS AND PARTS OF MODELS

GOODNOW & WIGHTMAN BOSTON

HOLD ON THERE!

Send 3c. for catalog of
Monarch Marine. Gasoline Engines
¾ to 45 H. P. $200 up.
Grand Rapids Gas Engine & Yacht Co.,
Grand Rapids, Mich.

PROSPECTIVE BOAT BUYERS.



By constructing your boat from a set of my **Boat Building Materials** more than one-half the boat factory's price can be realized. Also economize freight 500 per cent. Launches, Sail and Row Boats, Gasoline Engines. *Catalog free.*

FRED MEDART, 3545 DeKalb St., St. Louis, Mo.

OUTING

AN ILLUSTRATED MAGAZINE OF SPORT TRAVEL ADVENTURE AND COUNTRY LIFE

EDITED BY CASPAR WHITNEY

ARE YOU INTERESTED IN

Golf, Yachting, Shooting, Photography, Tennis, Bicycling, Polo, Automobiling, Fishing, Mountaineering, Country Living, College Sports, or in Horses, Dogs, Birds, Game Protection and Forestry Preservation?

Especially Important Articles apropos **SIR THOMAS LIPTON** and the **America's Cup**, and the Proposed Visit of **British Golfers.**

PRACTICAL PAPERS ON

Country Living and Country Homes, Care of the Garden, Fine Poultry, Pedigree Cattle and Horse Breeding in America, England and France.

OWEN WISTER

writes in OUTING for JUNE

—ON—

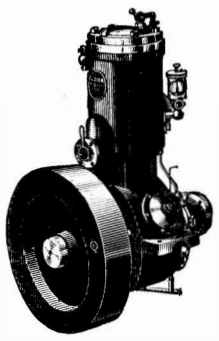
Theodore Roosevelt

The Sportsman and the Man.

WRITE FOR SPECIAL OFFER to NEW SUBSCRIBERS

The Outing Publishing Co., 239 Fifth Av. New York.

© 1901 SCIENTIFIC AMERICAN, INC.



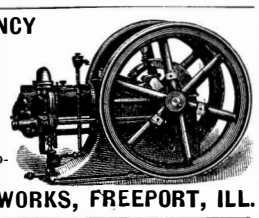
LOZIER

GAS ENGINES LAUNCHES

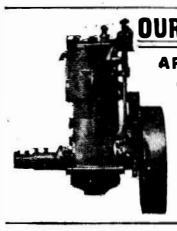
Three handsomest and most elaborate catalogues ever published sent free on receipt of five stamps for mailing.

THE LOZIER MOTOR CO.,
26 Water Street, PLATTSBURGH, N. Y.

HIGHEST EFFICIENCY
attained in the
STOVER GASOLINE ENGINE

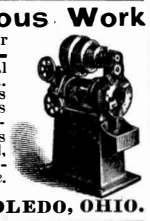


The best is always cheapest. *Write for prices.*
STOVER ENGINE WORKS, FREEPORT, ILL.



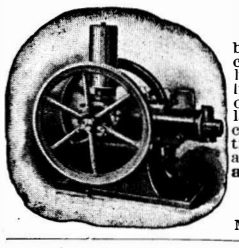
OUR MARINE MOTORS ARE GUARANTEED TO GIVE SATISFACTION.
Durable in Construction and Easy and Safe in Operation.
☞ *Send for Catalogue and investigate our claims.*
TRUSCOTT BOAT MFG. CO.,
St. Joseph, Mich., U. S. A.

For Heavy Continuous Work



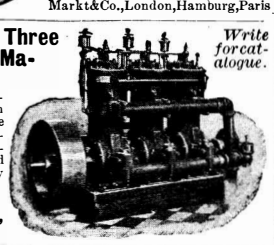
every machine shop will commend our **Power Pipe Threading and Cutting Machine.** Cones are central over machine, equalizing the weight. Within the cones are compound gears giving six changes of speed. Gears require no extra space, and are protected from dust or accident. Chasers can be opened, threaded pipe removed, another inserted and cut without stopping machine. ☞ *Send for Catalogue.*
THE MERRELL MFG. CO.,
501 Curtiss Street, TOLEDO, OHIO.

THE MIETZ & WEISS KEROSENE and GAS Engine



burns **KEROSENE** cheaper and safer than gasoline. Automatic, simple, reliable **No** electric battery or flame used. Perfect regulation. Belted or directly coupled to dynamo for electric lighting, charging storage batteries, pumping **and all power purposes.**
☞ Send for Catalogue.
A. MIETZ,
128-138 Mott St., New York.
Markt&Co., London, Hamburg, Paris

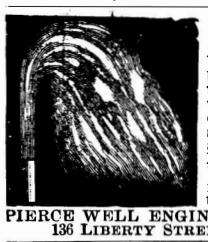
The "Wolverine" Three Cylinder Gasoline Marine Engine.



Write for catalogue.

The only reversing and self-starting gasoline engine on the market. Lightest engine for the power built. Practically no vibration. Absolutely safe. Single, double and triple marine and stationary motors from ¾ to 30 H. P.
WOLVERINE MOTOR WORKS,
Grand Rapids, Mich.

ROTARY ENGINES.—ARTICLES ON this type of engine, giving many details and illustrations, are contained in SUPPLEMENT Nos. **1158, 1186, 1193** and **1309.** Price 10 cents each. For sale by Munn & Co. and all newsdealers.



ARTESIAN
Wells, Oil and Gas Wells drilled by contract to any depth from 50 to 3000 feet. We also manufacture and furnish everything required to drill and complete same. Portable Horse Power and Mounted Steam Drilling Machines for 100 to 1200 feet. Write us stating exactly what is required and send for illustrated catalogue. Address
PIERCE WELL ENGINEERING AND SUPPLY CO.
136 LIBERTY STREET, NEW YORK, U. S. A.

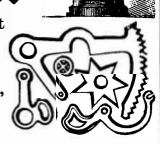
GASOLINE MOTOR CASTINGS
For MARINE, VEHICLE and BICYCLE MOTORS,
with Working Drawings.
LOWELL MODEL CO., 22 Wiggin St., Lowell, Mass.

"The recognized authority on Wiring and Construction."
STANDARD WIRING

for Electric Light and Power, as adopted by the Fire Underwriters of the United States; by H. C. CUSHING, Jr., A.I.E.E., Electrical Engineer and Inspector; in use by over 36,000 Electrical Engineers, Central Station Managers and Wiremen. Because it is the only book on Wiring and Construction kept strictly up to date. Flexible Leather Cover, pocket size, **$1.** Sent postpaid upon receipt of price, by
H. C. CUSHING, Jr., 39 Cortlandt Street, New York City.

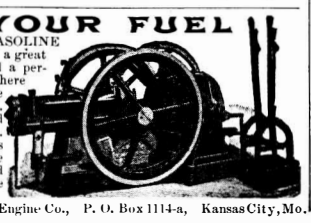
Special Machinery, Dies and Tools.
Sub-Press-Dies

For Punching and Forming Sheet Metal, A SPECIALTY.



CEO. M. GRISWOLD,
New Works, Griswold Building,
33-35-37 Union St.,
NEW HAVEN, CONN.

SAVE YOUR FUEL
You will find our GASOLINE **Hoisting Engines** a great saving over steam and a perfect economical boon where wood, coal or water are scarce and high priced. Both friction and geared hoist from 6 to 150 H. P. for mines, quarries, docks etc. Every machine fully guaranteed. Send for free catalog and state size of engine wanted.



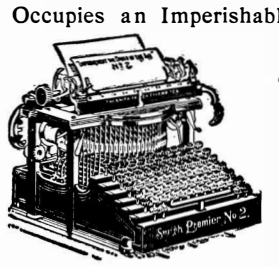
Weber Gas & Gasoline Engine Co., P. O. Box 1114-a, Kansas City, Mo.

Folding box, Marlin & Beck	674,537
Fuel supply apparatus, F. E. Whittemore	674,641
Fur from pelts, machine for cutting, C. E. Sackett 674,472,	674,520
Furnace. See Underfeed furnace.	
Furnace, S. A. Knapp	674,649
Furnace and device for treating ore, C. J. Best	674,595
Gage. See Leather gage.	
Game, H. H. Stevens	674,848
Game board, E. T. Burrowes	674,729
Game boards, etc., adjustable revolving holder for, H. H. Liebenberg	674,782
Garment supporter, M. A. Irving	674,561
Gas apparatus, acetylene, O. H. Hampton	674,698
Gas, apparatus for making coal, E. M. Eidherr	674,695
Gas compressing engine, A. H. Helander, 674,410,	674,411
Gas engine, J. Rourk	674,709
Gas generator, acetylene, A. E. Schatz	674,587
Gas generator, acetylene, J. A. Mosher, 674,611,	674,612
Gas generator, acetylene, Mosher & Wishart	674,613
Gas lock, safety, C. H. Lewy	674,582
Gas producer, H. Hyatt	674,772
Gas valve, C. E. Forsyth	674,606
Gate, R. H. Cornett	674,534
Gearing, F. W. Mase	674,447
Glass or porcelain ware, ornamenting, H. Thuemler	674,620
Glass pressing apparatus, R. Good, Jr	674,378
Gold separating machine, J. Broyles	674,533
Governing supply of steam or other fluids under pressure, means for, C. M. Hobby	674,700
Governor for fluid compressors, automatic, N. A. Christensen	674,808
Grinder, sickle, S. C. Schofield	674,743
Grinding attachment, sickle, H. Parmer	674,468
Gun, machine, A. H. McAllister	674,811
Gun, spring, A. Huntley	674,771
Gunner's replotting apparatus, C. L. Phillips	674,517
Hair-drier, C. C. Hungerford	674,418
Hame, J. T. Sheils	674,387
Hame fastener, Bennett & Cowger	674,531
Hammer, F. C. W. Stelter	674,640
Hammer, power, A. Sack	674,711
Hammock, L. A. Wright	674,721
Hammock and reclining rocking chair, combined folding, J. E. Bergsten	674,664
Handle. See Tool handle.	
Harness support, E. F. McCafferty	674,707
Harvester tongue truck, J. F. Steward	674,484
Hat pin retainer, E. J. Weller	674,544
Hay press, Bridges & Smith	674,596
Hay press, W. L. B. Carter	674,836
Hearse, coffin or casket clamp, P. S. Heabler	674,766
Heater, F. C. Weber	674,590
Heater or furnace, Weber & Jewett	674,529
Heating device, F. J. Doyle (reissue)	11,908
Heel attaching machine, C. W. Woods	674,806
Heel cushion, J. Priestman	674,636
Heel trimming machine, A. McDowell	674,633
Helmet, L. Bortfeldt	674,392
Hinge, J. R. Carter	674,454
Hoops, manufacture of wire, I. Wagner	674,749
Horseshoe, W. E. Messacar	674,653
Horseshoe attachment, P. Wagner	674,488
Horseshoe, non-slipping, J. Patrick	674,655
Hot water and steam heater, J. E. Coombs	674,671
Hub, wheel, A. J. McCormack	674,512
Hydrant, H. See	674,477
Hydrous compounds, treating, A. E. Cummer	674,760
Hygienic handkerchief pocket or receptacle, A. M. Bevis	674,395
Ice can, P. Wall	674,489
Iron. See Sad iron.	
Iron borings or drillings, melting, B. H. Whiteley	674,545
Jar closure, J. Schies 674,713,	674,714
Key fastener, S. J. Kraemer	674,776
Key ring, flexible, R. D. Knight	674,775
Kiln. See Lumber kiln.	
Knitting machine, G. Blood, Jr	674,667
Knitting machine pattern mechanism, F. Wilcomb	674,546
Lace holder, shoe, M. J. Brott	674,494
Lamp, electric, C. B. Hull	674,770
Lamp, electric arc, R. E. Ball	674,642
Lamps, manufacture of electric glow, F. Blau	674,754
Last, E. L. Goding	674,697
Lathe, W. Schulte	674,542
Leather gage, M. Vassar	674,487
Legging, S. Bray	674,726
Lever, J. H. Baker	674,591
Lighting apparatus, vehicle, A. Brady	674,363
Liquid elevating wheel, B. S. Birdsall	674,396
Load transferring device, T. S. Miller	674,539
Loads from one track or position to another, apparatus for shunting suspended, Mackrow & Cameron	674,651
Locomotive sanding apparatus, J. Gapp	674,762
Logging engine, A. O. Lombard	674,737
Loom shedding mechanism, E. Herbertz	674,413
Loom take up mechanism, J. T. Meats	674,424
Loom, weft replenishing, Moore & Clark	674,632
Looms, repairable gearing for, A. Chevrette	674,600
Lumber jointing machine, W. A. Firstbrook	674,368
Lumber kiln, Dozier & Walker	674,498
Mail box, A. W. Smith	674,619
Matches, etc., case for the reception of, E. A. Gerken	674,461
Mattresses and metallic bedstead, metallic truss for woven wire, C. H. Hard, 674,379,	674,380
Measure, tailor's, A. P. Hockersmith	674,442
Measuring vessel, C. P. Haegg	674,503
Meat extracts, purifying, G. Lebbin	674,781
Metal bending machine, C. Decrette	674,574
Metallic stripping plates, making, E. Saillot	674,430
Metals from their ores, apparatus for separating, W. A. R. Loose	674,563
Micro-organisms, inoculating seeds with, R. Hartleb	674,765
Micro-organisms, nutrient medium for producing cultures of bacteroids of, R. Hartleb	674,764
Milk can, W. H. Wright	674,570
Mill. See Feed mill.	
Mineral wool brick, G. Kelly	674,774
Mop head, N. Svenson	674,524
Motor controlling device, H. S. Bristol	674,643
Motor elevator, movably suspended, J. Benik	674,753
Motor, apparatus for generating and supplying motive power to, L. E. H. Fievet	674,676
Mouse trap, C. R. Botsford	674,669
Music sheets, books, etc., holder for, G. A. Bisler	674,668
Musical instrument, J. C. Deagan	674,604
Musical instrument, self-playing, G. H. Davis	674,552
Musical instrument strings, buffer stop knot for, A. Shaeffer	674,618
Nailing machine, H. W. Morgan	674,466
Nest, trap, W. Darling	674,437
Nozzle, spraying, C. Altenburger	674,371
Oils containing formaldehyde and making same, compounds of sulfonized mineral, L. O. Helmers	674,412
Ores, treating, C. J. Best	674,594
Ores, treating, M. Seligsohn	674,639
Outlet box, H. Ill	674,560
Packing for steam pistons, metallic, J. Wheelock	674,568
Paper feed mechanism, J. S. Bancroft	674,362
Paving block, R. D. Culver	674,672
Phonograph, A. L. Duwelius	674,575
Photographisc kit, J. Mathein	674,810
Photographic plate holder, F. W. Brehm	674,532
Photographic shutter, Turner & Clark	674,525
Physician's table, W. H. Kersey	674,682
Piano playing device, pneumatic, R. W. Pain	674,426
Picking and carding machine feeding mechanism, H. Tindell	674,746
Picture hook, W. Edmundson	674,438
Pin. See Clothes pin.	
Pipe wrench, E. Childs	674,399
Placket closure, Schutte & Saenger	674,474
Planter and fertilizer distributer, combined corn, Tunnicliff & Samuels	674,621
Plate holder and operating means, W. Scott	674,476
Plow, H. W. Menge	674,786
Plow harrow attachment, R. H. Steele	674,658
Plow, sculky, C. W. Dickinson	674,377
Pneumatic dispatch system, M. Anderson	674,373
Poke, animal, J. J. Heser	674,608
Potato digging machine, G. M. Cole	674,602
Power transmission gear, H. C. Capel	674,794

(*Continued on page 350*)

GRAND PRIZE, PARIS, 1900. HIGHEST AWARD POSSIBLE.

THE SMITH PREMIER TYPEWRITER
Occupies an Imperishable Position in the BUSINESS WORLD.



Unquestionable Superior Merit
Annually adds thousands of names to the long list of Smith Premier users, representing every line of trade and every profession. .....
ILLUSTRATED CATALOGUE FREE.
The Smith Premier Typewriter Co.,
SYRACUSE, N. Y., U. S. A.

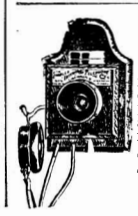
Save Money

by using the **Remington**
Typewriter users testify that it gives a better return for the investment than any other writing machine.
WYCKOFF, SEAMANS & BENEDICT,
327 Broadway, New York.

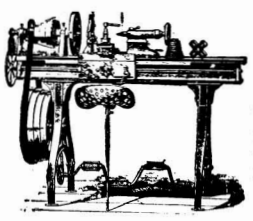
The Typewriter Exchange

1½ Barclay St., NEW YORK
124 La Salle St., CHICAGO
38 Bromfield St., BOSTON
817 Wyandotte St., KANSAS CITY, MO.
209 North 9th St., ST. LOUIS, MO.
432 Diamond St., PITTSBURGH, PA.
3 West Baltimore St., BALTIMORE, MD.
536 California St., SAN FRANCISCO, CAL.
We will save you from 10 to 50% on Typewriters of all makes. *Send for Catalogue.*

ACETYLENE GAS AND CARBIDE OF Calcium.—All about the new illuminant, its qualities, chemistry, pressure of liquefaction, its probable future, experiments performed with it. A most valuable series of articles, giving in complete form the particulars of this subject. Details of furnaces for making the carbide, gas generators, gasometers, burners, etc. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. **998, 1004, 1007, 1012, 1014, 1015, 1016, 1022, 1035, 1038, 1057, 1064, 1071, 1072, 1082, 1083, 1084, 1085, 1086, 1104, 1124, 1132, 1149, 1150, 1203, 1204, 1206** and **1209.** Price 10 cents each, by mail, from this office, and all newsdealers.



Telephones,
for Interior, Short Line, Intercommunicating and Hotel Work. Write us for prices, catalogue, etc., with testimonials and references. Estimates cheerfully furnished. Agents wanted.
THE SIMPLEX INTERIOR TELEPHONE CO.,
431 Main St., Cincinnati, Ohio.

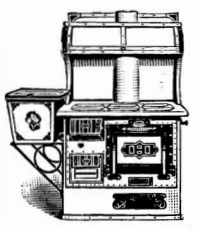


FOR GUNSMITHS, TOOL MAKERS, EXPERIMENTAL & REPAIR WORK, ETC.
From 9-in. to 13-in. swing. Arranged for Steam or Foot Power, Velocipede or Stand-up Treadle.

UPRIGHT DRILLS
Complete line, ranging from Light Friction Disk Drill to 42" Back Geared Self-Feed. Latest improvements. Up-to-date in every respect.
☞ *Send for Catalogue.*

W. F. & John Barnes Co., Established 1872.
1999 Ruby St., Rockford, Ill.

I PAY THE FREIGHT
WILL SHIP C. O. D. to any Station in the U. S. for
THE "WILLARD STEEL RANGE" $25
Has 6 8-in. lids, oven 17x12x21, 15 gallon reservoir, large warming closet, duplex grate, burns wood or coal, weighs 400 lbs., lined throughout with asbestos.
GUARANTEED TO BE AS REPRESENTED. Write for free descriptive circulars and testimonials from parties in your section who are using one.
WM. G. WILLARD, 619 North 4th Street, ST. LOUIS, Mo.

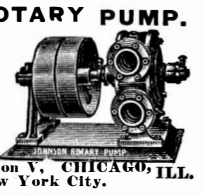


Bausch & Lomb Zeiss
STEREO
Binocular
Best in the world.
You will find it profitable to read our "Binocular Booklet" before you buy any kind of a glass, free at your dealers or by mail.
Bausch & Lomb
Binocular
A New Prism Glass
Excelled only by the STEREO
Lower in price.
For sale by all dealers
BAUSCH & LOMB OPT. CO.
Rochester, N.Y.
New York. Chicago

10 DAYS' TRIAL
to responsible parties.
DAUS' TIP TOP DUPLICATOR prints 100 copies in black from one pen written original and 50 copies from typewriter. It takes an expert to tell the duplicates from the original.
FELIX DAUS DUPLICATOR CO., 5 Hanover St., New York

"Perfection" Air Mattresses
(TRADE MARK) (AND CUSHIONS)
FOR ~ CAMP ~ YACHT ~ HOME ~ HOSPITAL.
NON-ABSORBENT, HYGIENIC, ODORLESS.
When deflated can be rolled into small package for storage or transportation.
Send for Illustrated Catalogue with Prices.
Mechanical Fabric Co. PROVIDENCE, R.I.

THE JOHNSON ROTARY PUMP.
Simple of construction, positive in action, easy and quiet in operation. Especially adapted to pumping soap, oil, sugar, lard, glucose, acids, starch, glue, varnish, corn and water, malt, etc. Large sizes for irrigation.
Made as a belt or steam pump, or combination, or operated by electric motor or gasoline engine. Manufactured by

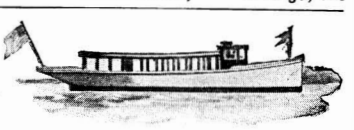


DAVIS-JOHNSON CO., Station V, CHICAGO, ILL.
95 Liberty St., New York City.

ADDITIONAL CAPITAL SUPPLIED
Charters Secured in any State. Stocks and Bonds Underwritten or Sold under guarantee and on commission. Good Inventions Marketed. Cash furnished for any good enterprise.
DANIELS & COMPANY, Bankers,
6 Wall Street, New York.
Also London, Philadelphia, Boston, San Francisco.

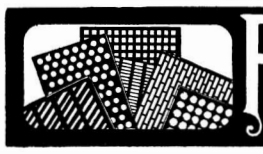
TELEPHONES SOLD OUTRIGHT.
All kinds of Telephone Apparatus. Absolutely guaranteed. Switchboards for large or small exchange.
Kellogg Switchboard & Supply Co.,
243 So. Green Street, Chicago, Ill.

Our Specialty: Knock-Down Boats of any description.



AMERICAN BOAT & MACHINE CO.,
ROW, SAIL AND PLEASURE BOATS,
Marine Station. ST. LOUIS, MO.

ELEVATING - CONVEYING POWER TRANSMISSION MACH'Y COAL WASHING MACHINERY
The JEFFREY MFG. CO., Columbus, O., U. S. A.
For Catalogues Address
Coal Mining Machines
ELECTRIC MINE LOCOMOTIVES
POWER COAL DRILLS
COAL HANDLING MACHINERY



PERFORATED METAL
OF EVERY DESCRIPTION AND FOR ALL USES.
THE HARRINGTON & KING PERFORATING CO. 225 N. UNION ST., CHICAGO, ILL. U.S.A.

© 1901 SCIENTIFIC AMERICAN, INC.

For Automobiles.

GOODYEAR ENDLESS SOLID TIRES

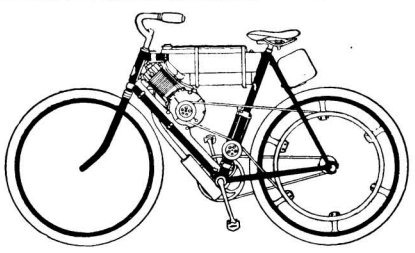
NO JOINT CREEPING TROUBLE

Outwears ALL OTHERS.

☞ *Write for Catalogue and Prices.*

The Goodyear Tire and Rubber Co.
AKRON, OHIO, U. S. A.
Largest Tire Makers in the World.

THE BICYCLE: ITS INFLUENCE IN Health and Disease.—By G. M. Hammond, M.D. A valuable and interesting paper in which the subject is exhaustively treated from the following standpoints: 1. The use of the cycle by persons in health. 2. The use of the cycle by persons diseased. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1002.** Price 10 cents. To be had at this office and from all newsdealers.



THE HUNDREDS WHO ARE USING THE

Thomas Auto-Bi

delight in telling us of its enchanting use. There are more bicycle dealers handling the **AUTO-BI** than all other motor bicycles combined. This means it is the best and the only practical motor bicycle made.

☞ *Send for Catalogue and Testimonials.*

E. R. THOMAS MOTOR CO., 100 Broadway, Buffalo, N.Y.

50 MILES FOR 10 CENTS,
is the maximum cost of operating
Does not Get out of Repair; Has no 'Tricks'

The **MITCHELL**
Motor Bicycle

makes an average of 35 miles an hour over most any sort of road without effort and with

PERFECT SAFETY.

The Mitchell is a **Bicycle Automobile** built for one; is always under perfect control; as simple in operating as an ordinary wheel. It is built for wear and tear and not for a toy. **FULLY GUARANTEED. Information sent free.** M'f'd. only by **WISCONSIN WHEEL WORKS, Dept. G. Racine, Wis.**

Patee Motor Cycles, $200.

No other make of Motor Cycle can maintain a speed anywhere near equal to this wonderful machine. It is light, strong, serviceable and reliable. Will go every time, any time and all the time. No experiment, no plaything, fully guaranteed. Money refunded if not as described. Big trade discount. **WRITE US.**

PATEE BICYCLE CO., Indianapolis, Ind., U. S. A.

THE HUB
will keep you posted on
Automobiles.
At news stands or by mail, 25 cents. Six months' subscription $1.00.
THE HUB,
Room 6,
24 Murray St., New York.

YOUR BICYCLE

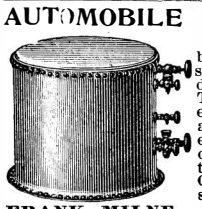
May need a new crank hanger or higher gear. We can furnish crank hangers complete with cups and cones, to fit any wheel. Write us for full information.
The Avery & Jenness Co., 60 S. Canal St., Chicago, Ill.

BY-THE-BYE, WHEN YOU BUY A BICYCLE
be sure and buy the best, and that means the
BUFFALO KING.
either "Racer" or "Special." The "Queen" is for a lady. No better built wheels on the market—every rider satisfied. Thoroughly up to date in improvements. All parts of best materials. Put together by skilled workmen. Prices, $35 and $40. Illustrated Catalogue free on application.

THE WM. HENGERER CO., Buffalo, N. Y., U. S. A.

HOW TO MAKE AN ELECTRICAL Furnace for Amateur's Use.—The utilization of 110 volt electric circuits for small furnace work. By N. Monroe Hopkins. This valuable article is accompanied by detailed working drawings on a large scale, and the furnace can be made by any amateur who is versed in the use of tools. This article is contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1182.** Price 10 cents. For sale by MUNN & Co., 361 Broadway, New York City, or by any bookseller or newsdealer

AUTOMOBILE STEAM BOILERS

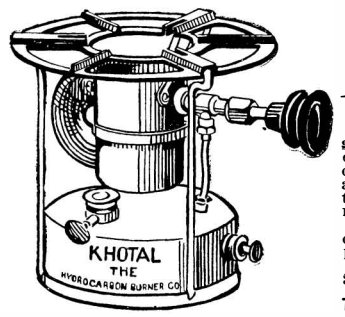


These Boilers are made of fire box steel, which has a tensile strength of 55,000 pounds. A double butt strap seam is used. The bottom end of shell is flanged to take flat head. This flange also takes care of difference in expansion between shell and copper tubes. Each boiler is tested to 600 pounds C. W. P. Can also furnish boilers with seamless cold drawn shell.

FRANK MILNE, - - - EVERETT, MASS.

Printing presses, automatic register gage for, C. H. Booton	674,532
Pump, W. J. P. Moore	674,789
Pump, direct acting air, F. M. Wheeler	674,819
Pump, fuel supply, L. H. Nash	674,385
Pump jack, G. Alderson	674,662
Pump, steam, T. F. Flinn	674,440
Pump valve, steam, J. H. Bullard	674,845
Push button, S. Bower	674,398
Rails at level crossings, etc., automatic device for opening or closing spaces between, E. Wadey	674,748
Railway line conductor, electric, A. Palmros	674,467
Railway, pleasure, H. B. Walter	674,750
Railway switch, I. Robbins	674,518
Railway switch, P. H. De Rochemont	674,535
Railway switch, I. Wantling	674,567
Railway switches, means for throwing, L. Davis	674,626
Railway track, W. Goldie	674,370
Railways, automatic signal for electric, C. H. Storm	674,523
Railways, closed conduit system of electric, F. C. Esmond	674,458
Refrigerating apparatus, G. H. Abrams	674,822
Refrigerating system, E. C. Hall	674,463
Refrigerators, etc., automatic overflow device for, C. W. Grant	674,830
Relay, F. D. Pearne	674,540
Ribbon reversing mechanism, automatic, C. E. Dellenbarger	674,826
Ring. See Key ring.	
Robe and vehicle cover, storm, S. Walbert	674,818
Rocker cushion, J. H. Fink	674,500
Roller mill for grinding and crushing, J. C. Wegerif	674,718
Rolling metal bars, P. & R. Mergler	674,652
Roof, W. H. Grow	674,579
Rotary engine, B. Ljungstrom	674,422
Rotary engine, M. Van Gelder	674,716
Rotary motor, H. O. Gadberry	674,837
Ruler, C. E. Jewell	674,648
Ruling machine, C. Burrows	674,434
Sad iron, T. F. Hagerty	674,504
Saddle cushion, W. I. Bunker	674,451
Saddles, bucking roll for stock or Mexican, J. Clark	674,757
Safety hook, W. D. Jewell	674,383
Sash holder and fastener, O. D. Reeves	674,637
Sawing machine, circular, A. Hillmann	674,558
Scale, A. De Vilbiss, Jr	674,646
Scale, hydrostatic computing, S. Bengston	674,571
Scraper, road, E. P. Lynch	674,703
Screw driver, G. L. Woodruff	674,719
Seat. See Drop seat.	
Sewing machine looper mechanism, E. Murphy	674,614
Sewing machine trimming mechanism, Dimond & Dial	674,605
Shade and curtain holder, window, C. Fleming, Jr.	674,677
Shade roller bracket, N. L. Holmes	674,414
Shade roller, extensible, C. A. Baker	674,752
Shaft coupling, F. Shaw	674,479
Shaft coupling and anti-rattler, combined, J. J. Kocher	674,444
Shell, explosive, R. MacMartin	674,509
Shingling bracket, J. B. Casebolt	674,756
Sifter, ash, W. McKeever	674,513
Sign, illuminated, Smith & Watson, 674,798, 674,799,	674,816
Signal holder, W. F. Coston	674,400
Signaling device, electric, C. F. Wilder	674,660
Singletree, doubletree, etc, J. Macphail	674,583
Skate, roller, T. W. Bryant	674,727
Skate truck frame, roller, T. W. Bryant	674,728
Skipping rope, W. C. Black	674,431
Snatch hook, W. T. Germany	674,462
Spanner, F. O. Lagerbeck	674,778
Spectacles, J. Wagner	674,527
Speed regulator, mechanical, G. E. Lob	674,423
Spinning and doubling machinery, formation of cops in, T. Ashworth	674,723
Spirits, electrolytic process of purifying crude, Lavollay & Bourgoin	674,780
Spoon, P. Marx	674,446
Spray tube for nebulizers, W. & J. Boekel	674,833
Stacker, hay, W. A. Cavett	674,495
Stamp affixing machine, A. S. Heintz	674,733
Starching machine, F. W. Collier	674,497
Stereoscope, A. W. Jones	674,443
Stirrup, W. M. Stewart	674,485
Stocking supporter, duplex, J. A. Hudson	674,559
Stone veneer, artificial, J. C. McClenahan	674,615
Storage battery, W. Gardiner	674,501
Stove, J. E. Hausfield	674,464
Stove door, Carter & Hausfield	674,453
Suit hanger, folding, E. E. H. Heinrich	674,557
Suspender end attachment, C. H. Dome	674,731
Swing, D. C. Coble	674,496
Tap and pump, combined, Mohn & Larm	674,510
Teeth, root canal filling for, C. T. Kinsman	674,419
Telegraph system, typewriting, F. D. Pearne	674,469
Telegraphy, electric, O. J. Lodge	674,846
Telephone line calling apparatus, party, J. O'Connell	674,515
Telephone or telegraph instrument protector, J. Piel	674,541
Telephone switchboard, H. A. Douglas	674,402
Telephone system, Yaxley & Cadden	674,807
Telescope, B. A. Fiske	674,576
Telescope, prism, C. Hensoldt	674,465
Tellurian, A. A. Hoylman	674,768
Thill jack, vehicle, C. H. Puffer	674,815
Ticket holder and indicator plate, F. W. Taylor	674,802
Timber separator, T. E. Comly	674,455
Tire, pneumatic, W. Covintree	674,436
Tire, solid rubber vehicle, F. A. Seiberling	674,478
Tire valve, M. M. Brown	674,572
Tires, automatic pump for, A. C. & L. S. Anderson	674,722
Tobacco leaves, apparatus for sorting, B. O. Dahl	674,573
Tongue support, H. C. Burk	674,452
Tool, D. O. Brunner	674,693
Tool, combination, S. J. Johnson	674,735
Tool handle, J. C. Lambert	674,702
Track gage, R. Magnuson	674,564
Trap. See Animal trap.	
Trolley, J. Trickel	674,589
Trolley, A. Palmros	674,740
Trolley wire clip, J. W. Perry	674,617
Trolley wire hanger clamp, G. H. Ricke	674,656
Trolley wire supporting and connecting device, G. H. Ricke	674,657
Trousers or gown hanger, E. E. H. Heinrich	674,556
Truck, elevating, K. G. Rickards	674,471
Trunk handle, Wilhite & Hoyt	674,820
Truss, Demarre & Eckhart	674,645
Truss, hernial, J. W. Bunker	674,598
Tube, Beck & Townsend	674,394
Tunneling apparatus, D. L. Hough	674,415
Turbine or water wheel, compound, C. V. Staley	674,800
Twine holder and take-up, J. T. Bunting, Sr.	674,433
Type casting and composing machines, die centering mechanism for, J. S. Bancroft	674,376
Type casting and composing machines, galley mechanism for, J. S. Bancroft	674,375
Type casting or other machines, fluid injecting mechanism for, J. S. Bancroft	674,374
Typewriter attachment, A. J. Speare	674,482
Typewriter keyboard, J. B. Vidal	674,747
Typewriter paper tension, A. W. Steiger	674,588
Typewriting machine ruling and ornamenting mechanism, C. W. Howell, Jr.	674,416
Umbrella lock, T. J. Zoeller	674,390
Underfeed furnace, W. R. Wood	674,548
Under reamer and expansion bit, E. North	674,793
Valance support, J. M. Higley	674,609
Valve, W. F. Mullaney	674,790
Valve, electromagnetic, N. O. Lindstrom	674,683
Valve mechanism, exhaust, A. B. de Bouvand	674,397
Valve regulating device, waste, J. A. Hollenberger	674,507
Valve rotary, C. H. Parshall	674,684
Valve, safety, C. F. Fernald	674,674, 674,675
Valve seat, air blast, W. Fuller	674,460
Valve, water supply, H. Gardenier	674,696
Vapor burner, S. E. Freeman	674,578
Vehicle equalizing support, A. K. Wolfe	674,821
Vehicle, motor driven, J. C. Bleyney	674,666
Vehicle steering device, horseless, F. R. Hiester	674,409
Vehicle wheel, H. J. Wright	674,720
Vehicles, clutch device for self-propelling, L. A. Schlebecker et al.	674,521
Vending machine, D. E. Cody	674,601
Veneer cutter, F. Kraus	674,562
Veterinary surgical instrument, G. T. Mills	674,738
Voting machine, W. A. Swaren	674,388

(Continued on page 351)



Write for Free Illustrated Book G.

The "Khotal" *Blue Flame Oil Stove*

(FOR HOME OR CAMP OR YACHT)

generates gas from common kerosene. It will boil a quart of water in two minutes and cook a dinner quickly. It can be regulated to any desired degree of heat. It has no wick and no asbestos substitute. It is strong, durable and ornamental, being made of brass of superior finish and excellent workmanship. A child can operate it.

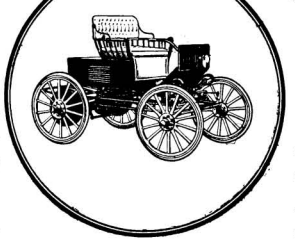
The "Khotal" costs little to buy and little to run. The combustion is perfect; no smoke, no smell, no soot deposit on pots and pans.

Picture shows smallest size, 8 ins. high, weight 5½ lbs. Price $3.75. Made in sizes large enough to cook a course dinner.

THE HYDROCARBON BURNER CO., 197 Fulton St., New York
Boston, Mass.: Globe Gas Light Co., 77-79 Union St,

The NATIONAL

EXCELLENCE ELEGANCE



ROAD WAGON—Style G. $1,000.

National Automobiles are always ready to run, do not "freeze up" in winter or roast you in summer, have no unpleasant odor, do not leave a trail of blinding vapor and are noiseless.

To appreciate **The National** you should own one of "the other kind" first, but as you can't do this send us ten cents in stamps for our "Auto Book." If you contemplate purchasing an Automobile, this will be the best ten cent investment you ever made.

Illustrated pamphlet mailed free to any address

The National Automobile & Electric Co.
INDIANAPOLIS, IND.
1115 East 22d Street.

THE ORIGINAL AND GENUINE ::

Rubber Goods. Perfectly imitate linen. Are durable and keep white. They go to all parts of the Globe. Write for Catalog. We want Agents everywhere. M'f'd only by

Windsor Collar & Cuff Co., Windsor, Conn.

SHOE BLACKING.—FORMULAS FOR liquid and solid blacking are given in SUPPLEMENT Nos. **1213** and **1239**. Price 10 cents each. For sale by Munn & Co. and all newsdealers.

THE LIGHT THAT WON'T FAIL.

Every smoker ought to carry the
"SUCCESS" AUTOMATIC MATCH SAFE.
Less than ¼ inch thick. Fits vest pocket like a visiting card. Handsomely nickeled. Easily filled. Match strikes as it comes out. Will last forever. Price **25** cents.
☞ SPECIAL OFFER TO GOOD AGENTS.
SUCCESS INTRODUCTION CO., 154 Fifth Ave., New York City.

ELECTRIC LAUNCH MOTOR.—THE design in this paper is for a motor of unusual simplicity of construction, which can easily be built by an amateur at small cost. It is intended for a boat of about 24 feet over all and 4 feet 6 inches beam, drawing 18 inches, and is capable of propelling such craft at a speed of 7 miles per hour. Illustrated with 21 cuts. See SCIENTIFIC AMERICAN SUPPLEMENT, No. **1202.** Price 10 cents by mail, from this office, and from all newsdealers

DICKERMAN'S DURABLE DESKS
Don't buy until you get our catalogue—100 pages of money saving values.
AMERICAN STORE STOOL CO., 33 Howard St., New York

MORROW COASTER BRAKE.

FITS ANY CYCLE 100,000 IN USE
ADDS PLEASURE AND SAFETY—ALL DEALERS SELL THEM.
RIDE 50 MILES—PEDAL ONLY 35. SEND FOR BOOKLET. ECLIPSE MANUFACTURING CO., BOX X, ELMIRA, N.Y.

The Applause of..... Thousands

Is the reward of the winner

G & J Tires

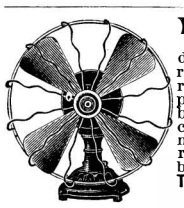
are

Fastest--Safest

Detachable——Double Tube——Corrugated
Catalog upon request
G & J Tire Company, Indianapolis

AUTOMOBILE AND MARINE MOTORS AND TRANSMISSIONS.
FOR THE **BEST** WRITE TO
BUFFALO GASOLENE MOTOR CO.
10-20 BRADLEY ST. BUFFALO N.Y.

BICYCLE TIRE REPAIRING.—THE Mending of Single Tube Tires.—A practical article illustrating the method of inserting patches and plugs with pliers and pluggers, together with rubber band plugging and the use of puncture bands. 9 illustrations. Contained in SUPPLEMENT **1102.** Price 10 cents. For sale by Munn & Co. and all newsdealers.



FAN MOTORS
Our fan motors are artistic in design and very economical in current consumption. They can be run at four speeds and are equipped with swivel joint to throw the breeze in any direction. Mechanical construction is of the best. The machines are absolutely quiet running. If interested, send for booklet B X.
The Holtzer-Cabot Electric Co., Boston (Brookline), Mass.

GAS ENGINE DETAILS.—A VALUAble and fully illustrated article on this subject is contained in SUPPLEMENT No. **1292.** Price 10 cents. For sale by Munn & Co. and all newsdealers.

TUBULAR DRIVING LAMP.

IT is the only perfect one.
IT will not blow or jar out.
IT gives a clear, white light.
IT is like an engine headlight.
IT throws the light straight ahead from 200 to 300 ft.
IT burns kerosene,
Send for book (free).
R. E. DIETZ CO., 60 Laight Street, New York.
Mention this paper and get special discount.
—ESTABLISHED 1840.—

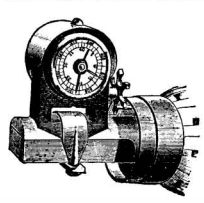
Building Edition Scientific American

MONTHLY, $2.50 PER ANNUM.
SINGLE NUMBERS, 25 CENTS.

The BUILDING EDITION for 1901 is the handsomest magazine in the United States. It has many new and important features. Send 25 cents for the March number, and see the new departments. The illustrations and cover are more attractive than ever. Send for "Are You About to Build?" and be convinced.

NEW DEPARTMENTS.
Monthly Comment.
Interviews with Architects.
New Books.
New Building Patents.
Notes and Queries.
Digest of Current Articles.

MUNN & CO.,
Publishers, 361 Broadway, New York.



The .. Improved **BELL ODOMETER**

APPLIED TO YOUR AUTOMOBILE .. OR .. CARRIAGE

will give you the exact distance traveled, and announce each mile passed by the stroke of a bell.

Send for Descriptive Circular S.

S. H. DAVIS & CO.
Cor. Portland & Sudbury Sts., Boston, Mass.

© 1901 SCIENTIFIC AMERICAN, INC.

The Search for Work

The man who can do something better than anyone else doesn't search for work. Employers search for him. We teach the theory of engineering and the trades to men already at work. Thousands of our students have secured a

Salary-Raising Education

in Mechanical, Electrical, Steam, Civil or Mining Engineering, Chemistry; Architecture; Plumbing; English Branches.

When writing state subject in which interested.

International Correspondence Schools, Box 942, Scranton, Pa.

ELECTRICAL ENGINEERING TAUGHT BY MAIL.

Write for our Free Illustrated Book.

"CAN I BECOME AN ELECTRICAL ENGINEER?"

We teach Electrical Engineering, Electric Lighting, Electric Railways, Mechanical Engineering, Steam Engineering, Mechanical Drawing, at your home by mail. Institute indorsed by Thos. A. Edison and others.

ELECTRICAL ENGINEER INSTITUTE, Dept. A, 240-242 W. 23d St., New York.

ROSE POLYTECHNIC INSTITUTE

A College of Engineering. Mechanical, Electrical, Civil Engineering; Chemical Courses; Architecture. Extensive shops. Modernly equipped laboratories in all departments. Expenses low. 19th year. For catalog, address C. L. MEES, President, Terre Haute, Ind.

The Bliss Electrical School

offers a Practical Course in Applied Electricity, complete in one year. Opens September 25th. Catalog on application to **L. D. BLISS**, Principal, **612 12th Street, N. W., Washington, D. C.**

FREE SCHOLARSHIPS

Improve your spare time. Get an education for which employers are willing to pay and pay well.

To introduce the high standard of the American School of Correspondence, the Trustees will award a limited number of Free Scholarships in **Electrical, Mechanical, Stationary, Locomotive, Marine ENGINEERING; Heating, Ventilation and Plumbing; and Mechanical Drawing,** to properly recommended applicants.

Application Blank on request.

AMERICAN SCHOOL OF CORRESPONDENCE, *(Chartered by the Commonwealth of Mass.)* Boston, Mass., U. S. A.

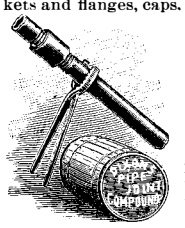
Learn to Write "Ads."

Our employed graduates are making good salaries. More than they ever commanded in other positions. Taught thoroughly by mail. Ad. writing is not genius, but an easily acquired business. *Literature on request.*

Page-Davis Advertising School, Suite 20, 167 Adams St., Chicago.

Better than Red Lead

For making joints in gas pipes, steam pipes, water pipes, compressed air pipes, and putting around gaskets and flanges, caps, headers, bolts and nuts, nothing excels



Dixon's Pipe-Joint Compound.

Joints can be easily taken apart after years of use even when the pipes are rusted. Manufacturers, machinists, engineers, contractors and gas companies freely use and endorse it. Booklet free.

JOSEPH DIXON CRUCIBLE CO.

Jersey City, N. J.

ACETYLENE BRILLIANCE

Such as our Generator produces, is almost sun-light; surpassing any other known artificial light. The flame has neither smoke nor smell; and yields 25 candle-power from each ½ ft. per hour burner.

The COLT TRADE MARK Carbide Feed Generator

Is based on the correct principles; it is safe, it is simple, it is economical; endorsed by the Pennsylvania State authorities; approved by scientists. Send for literature and our price list. $15 to $1000. 4 to 1000 lights.

THE J. B. COLT COMPANY

21 Barclay Street, Dept. S, New York.

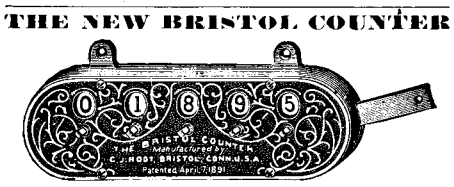
PHILADELPHIA. BOSTON. CHICAGO.

Criterion Stereopticons. Acetylene Search Lights.

SENSITIVE LABORATORY BALANCE.

By N. Monroe Hopkins. This "built-up" laboratory balance will weigh up to one pound and will turn with a quarter of a postage stamp. The balance can be made by any amateur skilled in the use of tools, and it will work as well as a $125 balance. The article is accompanied by detailed working drawings showing various stages of the work. This article is contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1184.** Price 10 cents. For sale by MUNN & Co., 361 Broadway, New York City, or any bookseller or newsdealer.

THE NEW BRISTOL COUNTER



Registers an accurate account of work done on printing presses, grain tallies, weighing, measuring and other automatic machines. Counts up to 1,000 000 and repeats automatically. Simple, accurate, durable. Special counters to order. ☞ *Send for circular.*

C. J. ROOT, Bristol, Conn., U. S. A.

Waffle iron, M. Griswold, Jr.	674,628
Washboiler, J. H. & W. W. Stull	674,689
Washer. See Bottle washer.	
Washing and bleaching compound, F. L. Bartell	674,593
Washing device, T. M. Pattison et al	674,742
Washing machine, Z. S. & M. C. Randleman	674,470
Washing machine, G. J. Cline	674,644
Washing machine, W. Acheson	674,661
Watch regulator, H. Sandoz	674,712
Water gage, self recording, O. C. Patton	674,634
Water seal or trap, J. J. Foy	674,439
Weather strip, S. D. Harling	674,838
Weighing machine, automatic, J. B. Schuman	674,386
Wheel for trucks, baskets, etc, J. Fowl	674,577
Wheelbarrow, E. B. Peirce	674,710
Windmill, A. Haraldson	674,554
Window, G. H. Watkins	674,490
Window washer, J. Ellis	674,366
Wire clamp and stretcher, J. Martin	674,445
Wire covering machine, Chamberlin & Murray	674,670
Wire fastening clip, J. H. Dunk	674,403
Wrench, J. Howell	674,767
Wrench, H. C. Stouffer	674,801
Wrench, W. H. Peters	674,814
Wrench and gripping device, combined, J. T. Godbout	674,680
Zinc bearing ores for obtaining zinc, etc., treating, S. O. Cowper-Coles	674,809

DESIGNS.

Badge, E. L. Logee	34,521, 34,522
Boiler brace, J. J. O'Brien	34,551
Box, paper, P. B. Myers	34,528
Cigar rolling machine roller arm, J. R. Williams	34,542
Cigar rolling machine top bed frame, J. R. Williams	34,543
Display box for pencils, penholders, etc., E. Berolzheimer	34,529
Display card, Heininger & Unger	34,530
Drinkin fountain base, Grunewald & Hooper	34,532
Drinking fountain, Grunewald & Hooper	34,531
Fabric, D. J. Seaman	34,554
Fire kindler, E. Pollard	34,550
Furnace tile, J. Murphy	34,552
Gear wheel, F. O. Bullis	34,547
Glove socket fasteners, back member for, E. Pringle	34,535
Golf ball, S. J. Cooper	34,557
Grinding plate, W. E. Copenhaver	34,544, 34,545
Hook, A. Brockelbank	34,533
Hook, V. A. Galagher	34,534
Jewel case, etc., H. T. Thomas	34,527
Lantern, G. Semler	34,537
Mopstick head, C. W. Hart	34,538
Nut lock, J. R. Williams	34,541
Pail cover, sap, A. A. Low	34,539
Pocket piece, A. R. Lache	34,523
Puzzle board, E. J. Appleton	34,556
Rug, A. Petzold	34,555
Scale bearing, F. O. French	34,536
Spoon, A. Phillips	34,526
Spoons, forks, etc., handle for, W. L. Wilks	34,524, 34,525
Stove, J. Eckert	34,553
Top, R. M. Pancoast	34,558
Truss support, Allison & Brown	34,546
Vehicle body, E. B. Gallaher	34,548, 34,549
Wrench, F. H. Engstrom	34,540

TRADE MARKS.

Ale, beer and porter, Frank Jones Brewing Co.	36,448, 36,449
Ammunition, certain named, Peters Cartridge Co.	36,461
Bandages, suspensory, Ware Mfg. Co.	36,454
Blasting powder, H. A. Weldy Powder Co.	36,460
Boiler cleaning compounds, certain named, International Boiler Cleaning Co.	36,458
Boots, shoes and leather, Rice & Hutchins,	36,437, 36,438
Butter, Acme Tea Co.	36,439
Canned goods, Beech-Nut Packing Co.	36,444
Churns, Norcross Manufacturing Co.	36,464
Cigarette paper, J. C. Drucklieb & Co.	36,445
Cigarettes, American Tobacco Co.	36,446
Cigars, Berriman Bros.	36,447
Egg beaters and cream whips, Landers, Frary & Clark	36,463
Fencing, wire, Dekalb Fence Co.	36,466
Flour, wheat, L. M. Paschall	36,443
Food products from milk, C. Richardson & Co.	36,441
Glass tubes, Schott & Gen.	36,462
Grease, J. H. Carter	36,459
Lotions, soaps, perfumery and proprietary medicines, A. Geissert	36,456
Maize rolled into flakes, Miner-Hillard Milling Co.	36,442
Medicinal substances, gelatin capsules containing, Allen & Hanburys	36,452
Pill, anti-bilious and tonic, J. W. Tresidder	36,453
Planes, Stanley Rule & Level Co.	36,465
Preparation for treatment of the hair and scalp, C. F. York	36,455
Remedies for certain named diseases, E. E. Sutherland Medicine Co.	36,451
Rubber bands, elastic, B. F. Goodrich Co.	36,436
Sarsaparilla, Clicquot Club Bottling & Extract Co.	36,450
Soap, certain named, A. F. Wooster	36,457
Stationery and materials for artists and draftsmen, L. & C. Hardmuth	36,435
Umbrellas and parasols, Gans Bros.	36,440

LABELS.

"Anti Trust Axe," for axes, J. H. Mann	8,403
"C. A. D. Cough and Lung Remedy," for a medicine, F. S. Walker	8,399
"Competitor," for packing, H. W. Johns Manufacturing Co.	8,401
"Cuban Splits," for cigars, Kraus & Co.	8,394
"Duke of York Mixture," for tobacco, Globe Tobacco Co.	8,395
"Eagle Remedies," for a medicine, W. Mayerhofer	8,398
"El Cabildo," for cigars, U. Koen & Co.	8,393
"Empire Celery Tablets," for a medicine, N. L. Douglass	8,397
"Great Rock Spring Water," for spring water, C. M. Decker	8,392
"Madre Queen Olives," for olives, Seville Packing Co.	8,389
"Monarch," for machine oil, Baird Bros. & Co.	8,400
"Olio D'Oliva," for olive oil, J. Okin	8,390
"Red Cross Antiseptic," for a medicine, W. De Arnold	8,396
"Silver Condensed Milk," for condensed milk, Hires Condensed Milk Co.	8,391
"Standard Crackers," for crackers, E. J. Kruce & Co.	8,387
"The Best Broom Made," for brooms, N. A. Allen	8,402
"The Juniata Axe," for axes, J. H. Mann	8,404
"Young's Home Made Chili Sauce," for chili sauce, F. Young	8,388

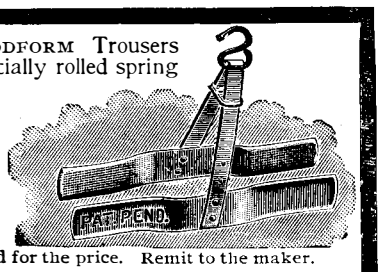
PRINTS.

"Broadway at Midnight," for cigars, S. W. Hoke	345
"For the Land's Sake," for fertilizers, Bowker Fertilizer Co.	348
"John Drew 5c. Cigar," for cigars, S. W. Hoke	346
"Kirkman's Borax Soap," for soap, Kirkman & Son	347
"The A. J. C. Band," for tanks, A. J. Corcoran	349

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents. In ordering please state the name and number of the patent desired, and remit to Munn & Co., 361 Broadway, New York.

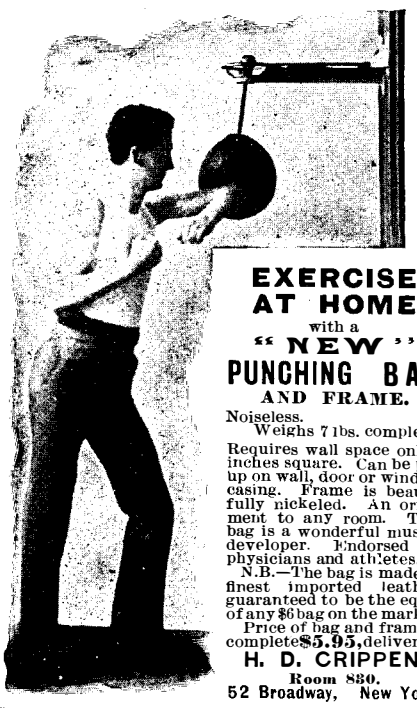
Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list, provided they are simple, at a cost of $45 each. If complicated the cost will be a little more. For full instructions address Munn & Co., 361 Broadway, New York. Other foreign patents may also be obtained.

GENTLEMEN: — The GOODFORM Trousers Hanger is made of fine, specially rolled spring steel, heavily nickel-plated on copper. The parts in contact with the fabric are wide and the edges rounded. It operates automatically. "You press the button," and the keeper does the rest. Sample by mail, 35c.; 3 for $1.00; 6 and a closet loop, $2.00. All express prepaid. **This is what you want if you want the best.**



Sold by Hardware and Furnishing stores, or prepaid for the price. Remit to the maker.

CHICAGO FORM CO., Dept. 76, 124 La Salle St., CHICAGO



EXERCISE AT HOME

with a

"NEW" PUNCHING BAG AND FRAME.

Noiseless.

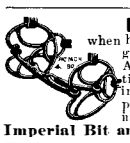
Weighs 7 lbs. complete. Requires wall space only 6 inches square. Can be put up on wall, door or window casing. Frame is beautifully nickeled. An ornament to any room. This bag is a wonderful muscle developer. Endorsed by physicians and athletes.

N.B.—The bag is made of finest imported leather, guaranteed to be the equal of any $6 bag on the market.

Price of bag and frame complete **$5.95,** delivered.

H. D. CRIPPEN, Room 880. 52 Broadway, New York.

DRIVING A PLEASURE



when holding your horse with an **IMPERIAL BIT,** giving 100 per cent more leverage than any other. Any lady can control the most vicious horse. Positive cure for tongue-lolling. Will prevent side pulling and driving on one line. Sent to any address, postpaid, upon receipt of price. In N C plate or imitation rubber, $1. In fine nickel plate, $2.

Imperial Bit and Snap Co., 14th Street, Racine, Wis.

EUROPEAN PATENTS FOR SALE.

I own the European rights—France, Germany and Belgium—of a useful and cheap kitchen utensil that will sell at sight. It is a Pot and Pan Scraper, so constructed that it can be handled at either end, for scraping out pots, pans, cupboards, spoons, etc., whether of square or round shape. Its edges are useful for the scraping of flat surfaces. Made in one solid piece of indestructible steel. Those interested please write to

CHAS. A. SUTTON, Pitkin, Colorado.

50 YEARS' EXPERIENCE

PATENTS

TRADE MARKS DESIGNS COPYRIGHTS &C.

Anyone sending a sketch and description may quickly ascertain our opinion free whether an invention is probably patentable. Communications strictly confidential. Handbook on Patents sent free. Oldest agency for securing patents.

Patents taken through Munn & Co. receive *special notice,* without charge, in the

Scientific American.

A handsomely illustrated weekly. Largest circulation of any scientific journal. Terms, $3 a year; four months, $1. Sold by all newsdealers.

MUNN & Co. 361 Broadway, **New York**

Branch Office, 625 F St., Washington, D. C.

"HOT BATH IN ONE MINUTE" FOR ONE CENT.

Moses, by the aid of a rod, struck a rock and got cold water. You by the aid of a

Humphrey Crescent Heater

strike a match and get hot water. They require no complicated piping, simply connect with water and gas in your bathroom. **Guaranteed.**

☞ *Write for Booklet.*

HUMPHREY MFG. & PLATING CO., Kalamazoo, Mich.

THE Topophone, $25

PREVENTS MARINE DISASTERS IN FOGS.

See SCI. AM., March 30, 1901, or write for Circular to **J. B. COLT CO., Room 1, 21 Barclay St., New York.**

ICE MACHINES, Corliss Engines, Brewers' and Bottlers' Machinery. THE VILTER MFG. CO., 899 Clinton Street, Milwaukee, Wis.

SHORTHAND BY MAIL. Pioneer home course *Catalogue and First Lesson Free.* **Potts Shorthand College,** Box 33, Williamsport, Pa.

½ H. P. GAS ENGINE CASTINGS

Materials and Blue Prints. Write for Catalogue 9. PARSELL & WEED, 129-131 W. 31st Street, New York.

STEEL TYPEWRITER TYPE

TYPE WHEELS, MODELS & EXPERIMENTAL WORK, SMALL MACHINERY NOVELTIES & ETC. NEW YORK STENCIL WORKS 100 NASSAU ST. N.Y.

MODELS & EXPERIMENTAL WORK. Inventions developed. Special Machinery. E. V. BAILLARD, Fox Bldg., Franklin Square, New York.

D'AMOUR & LITTLEDALE MACHINE CO. 130 WORTH ST., NEW YORK. PATTERN AND MODEL MAKERS.

STATLER'S Pan-American HOTEL

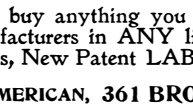
The Largest in the World. Send for map of city and Exposition grounds, also folder telling how to **SAVE MONEY** and secure accommodations.

F. C. STATLER, Prop. { Statler's Hotel, at Exposition. Buffalo, N. Y. { Statler's Restaurant, Ellicott Sq.

GEARS, UNION MODEL SUPPLIES. MODEL WORKS CATALOGUE FREE. 193 So. CLARK St. CHICAGO.

ASK FOR and **INSIST** on getting the quick open and quick shut **20th CENTURY UMBRELLA.** It will save your gloves, fingers and temper.

20th Century Umbrella Runner.



Pat. Jan. 9, 1900.

Opens with a Push. Closes with a Pull.

A. H. BAMBERGER, 381 Broadway, New York.

D. L. HOLDEN REAL ESTATE TRUST BLDG PHILA., PA. SOLE MANUFACTURER. **REGEALED ICE MACHINES** SEE FIRST PAGE SCIENTIFIC AMERICAN SEPT. 2. 1899.

BACKUS GAS AND GASOLINE ENGINE

Simple. Economical. Durable. Suitable for all kinds of work.

Backus Water Motor, cheapest power known.

Write for circular and prices.

BACKUS WATER MOTOR CO., Newark, N. J., U. S. A.

FOR SALE—A CHILD'S KNIFE BLADE

PATENTED April 23, 1901

To the highest Cash bidder within thirty days from date. All communications addressed to patentee **MRS. MARY A. HERR,** May 18, 1901. **Cape Girardeau, Mo.**

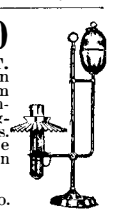
WANTED.

An experienced party to assist in the introduction of the Webster Air Brake Attachment. Patented in seven countries. Salary or commission.

WEBSTER AIR BRAKE ATTACHMENT CO., P. O. BOX 1466, MOBILE, ALA.

AGENTS MAKE FROM $200 to $500

a month handling the COMING LIGHT. Brighter than electricity, cheaper than kerosene. Thousands of testimonials from people using them over a year. Latest improvements. Endorsed by Ins. Co.'s. Largest factory in U.S. 41 styles. Lowest prices. Retail $4 up. Sample lamp half price. We want one agent, merchant or individual, in every town. Illustrated catalogue free.



STANDARD GAS LAMP CO., 118-120 Michigan Street, Chicago.

"THE HOGGSON" TIME STAMPS

CORRECTLY TIME Every Act, Operation or Transaction

Write for Cat. 267 W. 17th St. N. Y.

LYON & HEALY'S Own Make BRASS BAND

INSTRUMENTS. Indorsed by the great Jules Levy as the best in the world. **Big Catalog,** 400 illustrations, FREE. Positively the lowest prices on Band Instruments, Uniforms and Supplies of all kinds. Also contains Music and Instructions for New Bands. **Lyon & Healy, Manufacturers, 38 Adams st., Chicago.**

(Lyon & Healy are the largest music house in the world—Editor.)

? What Do You Want To Buy ?

We can tell you where to buy anything you want.

Write us for the addresses of manufacturers in ANY line of business.

Novelties, Special Tools, Machinery, Equipments, New Patent LABOR SAVING DEVICES.

MUNN & CO., Publishers of the SCIENTIFIC AMERICAN, 361 BROADWAY, NEW YORK.

© 1901 SCIENTIFIC AMERICAN, INC.

FOR MEN OF BRAINS

Cortez CIGARS

—MADE AT KEY WEST—

These Cigars are manufactured under the most favorable climatic conditions and from the mildest blends of Havana tobacco. If we had to pay the imported cigar tax our brands would cost double the money. Send for booklet and particulars.

CORTEZ CIGAR CO., KEY WEST.

THOROUGH INSPECTIONS

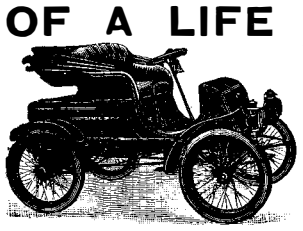
HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO. HARTFORD, CONN.

AND INSURANCE AGAINST LOSS OR DAMAGE TO PROPERTY AND LOSS OF LIFE AND INJURY TO PERSONS CAUSED BY

STEAM BOILER EXPLOSIONS

J. M. ALLEN, PRESIDENT · W. B. FRANKLIN, VICE PRESIDENT
J. B. PIERCE, SECRETARY · F. B. ALLEN, 2D VICE PRESIDENT
L. B. BRAINERD, TREAS. · L. F. MIDDLEBROOK, ASST SEC'Y

THE LUXURY OF A LIFE TIME



PRICE $1,200.

is experienced in one's first ride in a

WINTON MOTOR CARRIAGE

It is "so different" from any other method of conveyance and yet so delightfully interesting and appreciable. Every vehicle leaving our factory has been made under our personal supervision with the view to securing beauty of design, speed, safety and durability. Cost about ½-cent a mile. Hydro-Carbon system.

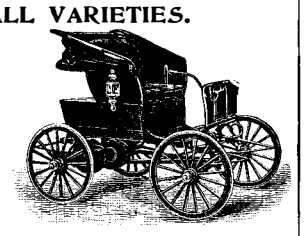
THE WINTON MOTOR CARRIAGE CO.,
486 Belden Street, Cleveland, Ohio, U. S. A.
EASTERN DEPOT, 150-152 East 58th Street, New York.

ELECTRIC VEHICLES

OF ALL VARIETIES.

STORAGE BATTERIES.

MOTORS.

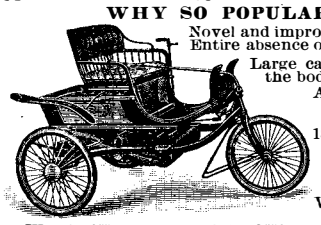


We make a specialty of Delivery Wagons and Busses. ☞ *Write for Catalogue.*

SCOTT AUTOMOBILE CO.,
3327-3939 Olive Street, St. Louis, Mo., U. S. A.

Knox Gasoline Runabout.

WHY SO POPULAR?



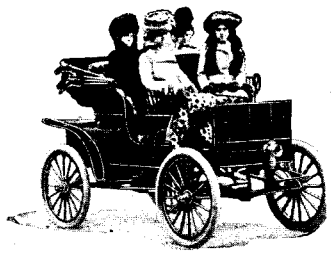
Novel and improved engine.
Entire absence of water.
Large carrying space in the body.
Ample power and all changes of speed.
180 miles on the six gallons of fuel carried.
Used in all parts of the country.
Very reliable on account of its extreme simplicity.

Weight 675 Pounds. Price $750.
Immediate Delivery.

LIST OF AGENTS.—A. P. UNDERHILL, 33 Stanhope Street, Boston, Mass. SPALDING-BIDWELL CO., 29 West 42d Street, New York City. W. E. ROACH, 821 Arch Street, Philadelphia, Pa. A. G. SPALDING & BROS., 147 Wabash Avenue, Chicago, Ill. SCOTT AUTOMOBILE CO., 3935 Olive Street, St. Louis, Mo. FISHER CYCLE & AUTOMOBILE COMPANY, Delaware Street & Massachusetts Avenue, Indianapolis, Ind.

KNOX AUTOMOBILE CO., SPRINGFIELD, MASS.

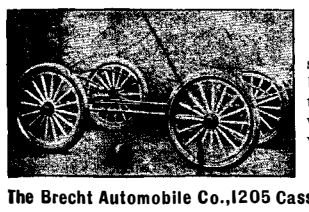
Awarded 100% and the Official Blue Ribbon for a Perfect Run of 109 Miles Without a Stop.



This prize was given the driver of one of our four-passenger pleasure automobiles, by the "Long Island Automobile Club," April 20th. Average time 15 miles per hour in a heavy rain and wind storm.

THE HAYNES-APPERSON CO., KOKOMO, IND., U. S. A.

GET A RUNNING GEAR and BUILD YOUR OWN AUTOMOBILE



We make two styles, solid rubber or pneumatic tires, complete with springs and wood wheels.

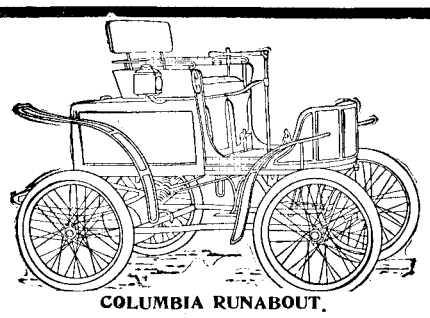
The Brecht Automobile Co., 1205 Cass Av., St. Louis, Mo.

WALTHAM WATCHES

The real value of a watch depends upon the accuracy of the movement and not upon the price of the case. The "Riverside" Waltham Watch Movement is an accurate watch in any case.

"The Perfected American Watch", an illustrated book of interesting information about watches, will be sent free upon request.

American Waltham Watch Company,
Waltham, Mass.



COLUMBIA RUNABOUT.

Columbia AUTOMOBILES

Electric Gasolene

IMPROVED 1901 MODELS FOR QUICK DELIVERY

FORTY MILES ON ONE CHARGE OF BATTERIES

Reliability in Service
Simplicity in Operation
Readiness in Action
Cleanliness in Handling

To obtain the leading type of vehicle at moderate cost it will pay you to
Write for 1901 Illustrated Catalogue or Call at
ELECTRIC VEHICLE CO., 100 BROADWAY, NEW YORK.

HERCULES WIRE ROPE

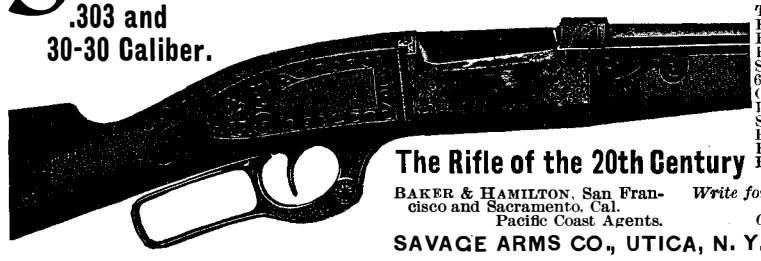
And all kinds of WIRE ROPE, Manila, Sisal, Blocks, etc.
Branch Offices: 92 Centre St., New York. 47-49 So. Canal St., Chicago, Ill.

A. LESCHEN & SONS ROPE CO.

MANUFACTURERS OF
LESCHEN CO.'S PATENT AERIAL WIRE ROPE
TRAMWAY.
The only satisfactory Tramway on the market.
ESTIMATES ON APPLICATION.
MAIN OFFICE:
920-922 North First Street, ST. LOUIS, MO.

SAVAGE MAGAZINE RIFLE

.303 and 30-30 Caliber.



The Only Hammerless Repeating Rifle. Smokeless 6 Shooter. One Rifle for Large and Small Game. Point Blank Range for Hunting.

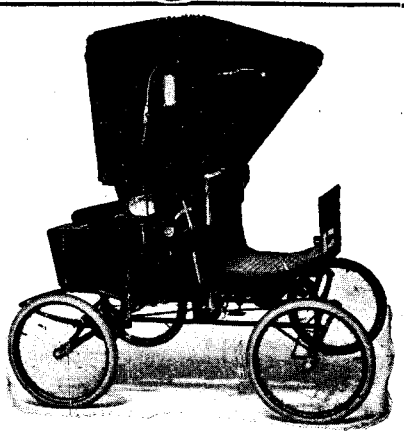
The Rifle of the 20th Century

BAKER & HAMILTON, San Francisco and Sacramento, Cal. Pacific Coast Agents.

Write for New Catalogue A.

SAVAGE ARMS CO., UTICA, N. Y., U. S. A.

"Locomobile"



STYLE 0003. VICTORIA TOP.

SOME OF THE IMPROVEMENTS NOW BEING ATTACHED TO "LOCOMOBILES."

Enlarged Water Tank.
Spring Coil Piping.
Extra Large Cylinder Oil Cup.
Gasolene Shut-off Valve from the Seat Feed Water Heater.

(This last gives a great saving of fuel and water, and makes the carriage steam in a remarkable manner.)

Address your inquiry to

The "Locomobile" Company OF AMERICA

7 East 42d Street, New York.

"KODAK"

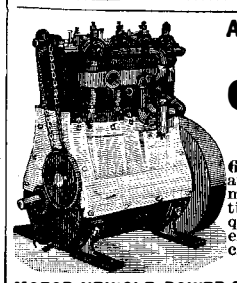
Stands for all that is Best in Photography

To the perfection of Kodak construction, to the perfection of the Kodak mechanism, to the perfection of the Kodak lenses, is due the

Triumph of Kodakery

All Kodaks Load in Daylight with our Transparent Film Cartridges. Several styles use either films or plates. Sixty-four page catalogue, describing them in detail, free at the Kodak dealers or by mail.

EASTMAN KODAK CO.
Rochester, N. Y.



A Reliable and Simple FOUR CYLINDER **Gasoline Motor**

6½ Brake Horse Power Guaranteed for Marine and Automobile use. Free from vibration, variable speed, starts on quarter turn. Prompt delivery. Additional information cheerfully given.

Catalogue for the asking.

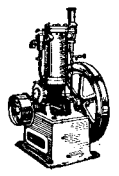
MOTOR VEHICLE POWER CO., 1229 Spring Garden St.
N.Y. Office, 62 Gold St. Philadelphia.

PATENTS PROTECTED

PATENT PROTECTED BY THE PATENT TITLE AND GUARANTEE CO. NEW YORK.

AGAINST INFRINGERS.
Dealers and Manufacturers of Patented Articles Protected against dangerous litigation at a nominal cost.
Also Copyrights and Trademarks.
Booklet on application.
PATENT TITLE & GUARANTEE CO.
Capital $500,000.00.
Telephone, 5533 Cortlandt.
150 Broadway, New York.

CHARTER ENGINE



USED ANY PLACE BY ANY ONE FOR ANY PURPOSE

FUEL—Gasoline, Gas, Distillate
Stationaries. Portables. Engines and Pumps, Hoisters
Send for Catalogue and Testimonials.
☞ State Your Power Needs

CHARTER GAS ENGINE CO., Box 148, STERLING, ILL.

WATCHES!

No advertisement can properly portray the striking effects produced in our watches. They are illustrated in our
BLUE BOOK showing Ladies' Watches in all metals and exquisite enamels; our
RED BOOK showing Men's and Boys' Watches
with up-to-date attractive designs.
Either Blue or Red Book sent on application.

THE NEW ENGLAND WATCH CO.,
37 & 39 Maiden Lane, New York City. 149 State Street, Chicago.
Spreckels Building, San Francisco.

CRACKS IN FLOORS

are unsightly, unclean and unsanitary.

GRIPPIN'S WOOD, CRACK AND CREVICE FILLER is the only perfect remedy. A Paste, easily applied, elastic, adhesive, and non-shrinkable. Dirt and moth proof. Cost about ½c. per sq. ft. 5 lbs. will treat an average room. Price 20 cts. per lb. State the kind and condition of wood when ordering, and full instructions will be given. Is also the best filler for open-grained woods.

GRIPPIN MFG. CO., Lock Box L, Newark, New York.
(Inclose stamp for booklet.)

HELMET OIL LUBRICATES ANYTHING.
IF YOU HAVE A HOT BOX TRY IT. C. H. BESLY & CO. CHICAGO. ILL. U.S.A.

TURN YOUR BIKE into AN AUTOMOBILE

THE BOISSELOT AUTOMOBILE CO.,
101 Beekman St., New York City,

Can tell you how to do this with one of their 1¼ *Actual* Horse Power Gasoline Motors. Under 20 lb. weight. Every motor tested and guaranteed full power. Motors of 2¾ *Actual* Horse Power, air and water cooled, for Voiturettes and Motor Tricycles. 6 *Actual* Horse Power Motors for Automobiles and Express Wagons. Motors for Launches. We also build several types of Automobiles.

STEWARD'S WONDER

Is the highest class Acetylene Gas Burner. All Lava Tips. A new argand burner $2.50—highest candle power obtainable. Correspondence solicited.
STATE LINE MFG. CO., Chattanooga, Tenn., U. S. A.

Scales All varieties at lowest prices. Best Railroad Track and Wagon or Stock Scales made. Also 1000 useful articles, including Safes, Sewing Machines, Bicycles, Tools, etc. Save Money. Lists Free. CHICAGO SCALE CO., Chicago, Ill.

JESSOP'S STEEL THE VERY BEST FOR TOOLS, SAWS ETC.
WM JESSOP & SONS LTD 91 JOHN ST. NEW YORK

© 1901 SCIENTIFIC AMERICAN, INC.